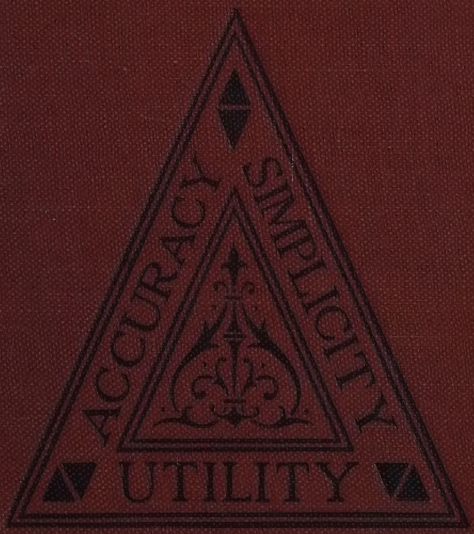
THE · TRIANGLE · ARITHMETICS ·



BOOK · TWO · PART · TWO

A. M. Crook

THE TRIANGLE ARITHMETICS

BOOK TWO—PART TWO

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Arithmetic—Book II—Part Two

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INTRODUCTION

TO THE BOYS AND GIRLS WHO WILL USE THIS BOOK

This arithmetic book has been written for you. It presents the activities of your life and of the life of those about you, which cannot be understood without the use of arithmetic. Arithmetic is used in almost everything you do both in and out of school. Whenever you purchase groceries, you use arithmetic. Whenever you measure your weight, your height, or the foods that you eat, you use arithmetic. Whenever you use the calendar, the clock, the thermometer, or read the speedometer on your father's automobile, you use arithmetic. In geography when you tell the size of cities, the value of the products of a country, the heights of mountains, or the depths of the oceans, you use arithmetic. When you count time in music, you use arithmetic. The farmer, the grocer, the banker, in fact everyone, uses arithmetic.

First of all you must be able to perform the simple operations of arithmetic quickly and accurately. A great deal of practice and drill are necessary to give you skill in addition, subtraction, multiplication, and division. You will find throughout this book many exercises to provide this practice. You will need to know what errors you make and why you make them. Tests are given which help you to locate your difficulties. Practice tests provide drill to be used to overcome these difficulties. Be sure to practice every exercise until you have mastered it.

The authors believe that boys and girls should solve real problems—problems which arise in your home life, in your school work, in your play and games, problems which your father and

mother must meet and solve, and problems about trade, business, and government. The problems in this book are about things in which boys and girls are interested. In many of the groups of problems there are topics which you will wish to discuss with your parents and friends, or concerning which you will need to consult encyclopedias, reference books, and magazines for information.

TO THE TEACHER

These textbooks embody the results of the scientific investigations of curriculum making, of the learning process, and of the psychological analysis of the steps in the various processes in computation. The contents follow closely the outlines of the best known courses of study. Special consideration has been given to the various reports contained in the Yearbooks of the Department of Superintendence, Yearbooks of the National Council of Teachers of Mathematics, Yearbooks of the Elementary School Principals, as well as to the results of the experimental work conducted by the authors to determine the causes of pupils' errors in computation and in problem solving. The whole development of the processes has been checked by careful classroom trial. The standards are based on the results of tests given to thousands of children.

THE DEVELOPMENT OF THE PROCESSES

a. Special stress is placed on the careful grading of the steps in each of the processes of fractions and decimals so that the pupils encounter only one new difficulty at a time.

b. Specific drill exercises are provided on the points which have been found by investigations to present special difficulty to pupils.

c. Stress is placed on the use of illustrative examples to which the pupils may refer when in difficulty. These examples have

made it possible to show pupils how to work examples differing slightly from the pattern presented in detail in the development.

d. Ample drill materials to fix each step in the development are provided, special stress being given to the elimination of the causes of error.

e. After a step has been developed, special provision has been made to insure the retention of the skill by scientifically distributed drill in subsequent exercises. Carefully standardized practice tests at the ends of chapters make it possible both to measure the achievements of the pupils from time to time and to review the work that has been done. The problem material especially provides for the continuous use of the processes that have been learned.

f. Provision is made for specific diagnostic exercises at the end of each development by means of which the pupils and teachers can make a careful check on the work that has been done. These diagnostic tests are made up of examples each of which represents a distinct type differing in some respect from the other examples in the test. The teacher is thereby enabled to determine the exact type of example which is difficult for the individuals in the class.

g. Objective tests for reviewing principles will be found from time to time at the end of the explanation of important development work.

h. In the development of each step the pupil is given specific directions as to procedure and a minimum of rationalization is undertaken.

i. From the beginning the pupils are taught to check their work.

THE PROBLEM MATERIAL

a. Each new step in a process is presented in some situation in which it is needed and as it functions in life.

b. The development of the processes is paralleled closely by the problem work, which applies the processes in life situations and insures a check on the power of the child to apply the process being developed.

c. The problem content stresses the social values of arithmetic and their applications to the life of the child in and out of school. Geography, reading, history, measurement, buying and selling, and the common business practices of everyday life are the sources of the problem material. Modern business practices are developed. Wherever possible data based on real life situations have been used in the problem units. Exact data contained in government reports, reports of farm clubs, scientific investigations, and other sources of information form the basis for the problem materials.

d. The pupil is frequently given cues to direct him in the solution of problems. The solution of problems is facilitated since they are real to the child and are within his experience.

e. Definite practice exercises on problem solving are found in the materials for both grades 5 and 6 as well as in the other grades.

f. At the end of each chapter are problem scales which have been carefully standardized. These scales make it possible to measure the progress during the year of the pupil in the ability to solve problems.

g. At the end of many of the problem units there are suggested activities and starred problems which suggest ways of applying what has been learned to situations both in and out of school. These problems suggest desirable forms of pupil activity and make it possible for the teacher to give a special type of work to the pupils who do not need all of the practice given in the problem or practice materials. The ability of the pupils to apply what has been learned to a real situation is the proof needed that the arithmetic he is learning actually functions.

h. The problems are stated clearly and simply in the vocabulary of the children of this grade.

THE SCIENTIFIC DISTRIBUTION OF NUMBER FACTS AND PROCESSES

a. In the development of the drill exercises on the fundamentals, special attention has been given to the scientific distribution of the number facts according to their learning difficulty.

b. Special stress has been placed on the necessity of giving the pupils contact with the varied types of examples in each of the processes. This has been found to be necessary since examples differ greatly among themselves in the specific methods by which they are solved, and the pupils should be given an opportunity to solve them in their drill work under the immediate supervision of the teacher.

c. The great care with which the steps in the development of the processes in fractions and decimals have been analyzed will be evident from a survey of the pages in which these processes are developed.

d. Standardized tests in all processes are found throughout the books. The standard that has been set up is reasonable speed and 100-per-cent accuracy.

PROVISION FOR INDIVIDUAL DIFFERENCES

a. The specially constructed diagnostic tests make it possible for the teacher to determine the nature of the difficulties of the individual pupils.

b. Pupils are directed to do special work on the particular types of examples which they find difficult in the diagnostic tests and practice exercises.

c. The practice exercises in each of the processes make it possible for the teacher to determine the particular process in which

the pupil is weak, and the element in each process which may be causing difficulty. These practice tests in fractions and decimals begin with simple elements and proceed to others that are increasingly difficult. Each test is therefore a scale by means of which the teacher can determine the level of the achievement of the individual pupils on repeated standardized measurements.

d. The problem scales make it possible for the teacher to select the pupils who are weak in problem solving. The special practice exercises in problem solving are especially helpful in work with these pupils.

e. At the end of many of the problem units there are starred problems. These are either more difficult problems than the others in the group, or are suggested activities which the teacher may assign to the superior pupils who have completed the minimum work expected of the class.

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CHAPTER I

OUR AMERICAN SCHOOLS

1. In a recent year there were 29,345,911 boys and girls between the ages of 5 and 18 years in our country. Of these, 24,288,808 were enrolled in the schools. How many boys and girls between these ages were not in schools?

2. In that year there were 155,206 elementary-school buildings, and 4,578 high-school buildings in the United States. What was the total number of school buildings in the country that year?

3. In a recent year the average cost of educating a pupil in each of five of our leading cities was as follows:

New York	$109.94	New Orleans	$81.05
Philadelphia	$88.69	San Francisco	$93.55
Detroit	$100.26		

Arrange these cities in a list according to the cost of educating a pupil.

4. What was the average amount a year spent for each pupil in these five cities?

5. What would it cost to educate a class of 40 children for one year in each of the cities in the list?

6. Counting 40 weeks as a school year, what was the cost for each pupil for one week in each of these cities?

7 Counting 5 days as a school week, what was the cost a day for each pupil's schooling? Drop fractions of a cent.

TESTS IN WORKING WITH WHOLE NUMBERS

This is a test of your ability to add, subtract, multiply, and divide whole numbers. Work as many examples as you can in the time allowed. Use folded paper when possible.

Addition (4 minutes, not including copying)

1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**
34	47	98	64	85	38	87	91
37	58	77	73	85	74	97	46
26	26	75	61	69	95	65	52
79	90	64	98	65	97	43	71
58	84	43	89	23	66	13	93
92	85	57	46	18	82	35	59
61	32	19	27	29	16	76	60

Subtraction (3 minutes, not including copying)

1.	**3.**	**5.**	**7.**	**9.**	**11.**
475	978	842	598	828	697
168	456	395	251	149	288
2.	**4.**	**6.**	**8.**	**10.**	**12.**
794	939	893	1,021	1,085	846
269	756	326	353	297	449

Multiplication (5 minutes. not including copying)

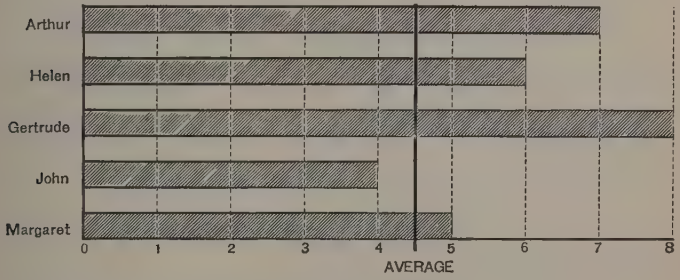
1.	**2.**	**3.**	**4.**	**5.**	**6.**
365	472	859	967	674	825
27	56	48	93	87	59

Division (10 minutes, not including copying)

1. $26\overline{)3,822}$	**4.** $73\overline{)19,345}$	**7.** $49\overline{)31,703}$	**10.** $74\overline{)29,230}$
2. $52\overline{)15,860}$	**5.** $84\overline{)45,024}$	**8.** $56\overline{)54,768}$	**11.** $56\overline{)41,260}$
3. $35\overline{)26,180}$	**6.** $94\overline{)66,552}$	**9.** $87\overline{)32,190}$	**12.** $87\overline{)52,026}$

GERTRUDE'S GRAPH

Gertrude kept a record of the scores which the children in the class made on the tests on page 2. The teacher showed Gertrude how to make a graph of the scores. Here is a part of her graph of the scores on the addition test. The heavy line is the class average.



1. How many examples did Arthur have correct?
2. Who had the largest number of examples correct?
3. Who had the smallest number of examples correct?
4. Who had half of the examples correct?
5. Who had $\frac{3}{4}$ of the examples correct?
6. What was the class average?
7. Which pupil is most likely in need of special work and practice in addition?
8. Make a graph, similar to the one Gertrude made, for the following scores on the subtraction test:

George—6 examples correct	Julia—9 examples correct
Mary—8 examples correct	Herbert—10 examples correct

9. Make a graph of the scores of the children in your row on one of the tests on page 2. Show the class average.

*10. Find examples of graphs for class discussion.

GRADED PRACTICE EXERCISES IN ADDITION

If your scores on the tests on page 2 were not satisfactory, practice the sets (pp. 4–8) in the process which you found difficult. Check your work. Practice until you can complete each set in the time allowed.

Set I (2 minutes)

1. 8	3. 9	5. 9	7. 7	9. 8	11. 8	13. 7	15. 9	17. 9	19. 7
5	3	7	2	5	4	2	3	2	2
2	4	2	5	3	5	4	3	6	7
2. 5	4. 7	6. 7	8. 7	10. 7	12. 6	14. 9	16. 9	18. 9	20. 9
3	4	4	6	5	6	5	8	3	7
8	9	6	5	9	6	5	3	9	8

Set II (2 minutes)

1. 6	2. 5	3. 8	4. 8	5. 2	6. 7	7. 8	8. 5	9. 1	10. 3
2	6	4	9	7	3	5	8	4	9
6	6	4	5	3	1	9	4	3	8
8	4	3	8	8	5	2	4	9	7
4	2	6	3	6	1	6	9	5	9
1	8	9	7	8	9	7	4	7	7

Set III (4 minutes)

1. 47	2. 96	3. 53	4. 41	5. 24	6. 34	7. 70	8. 90
71	52	78	37	97	43	20	95
62	87	78	68	26	35	93	84
76	56	63	49	52	93	86	92
97	69	84	55	72	46	31	82
89	81	49	68	59	92	11	86
19	57	86	99	37	89	18	79

Set IV (4 minutes)

1. 3,986 + 4,753 + 5,967 + 4,798 + 5,964 =
2. 487 + 790 + 564 + 856 + 73 + 9,846 =
3. 96 + 8,754 + 768 + 59 + 78,974 =

GRADED PRACTICE EXERCISES IN SUBTRACTION

Set I (3 minutes)

1. 521 356	**3.** 764 385	**5.** 483 295	**7.** 910 362	**9.** 823 476	**11.** 906 738
2. 921 432	**4.** 822 398	**6.** 844 279	**8.** 764 126	**10.** 929 136	**12.** 831 548

Set II (3 minutes)

1. 729 452	**3.** 942 299	**5.** 975 519	**7.** 642 386	**9.** 619 144	**11.** 734 278
2. 360 269	**4.** 404 382	**6.** 953 744	**8.** 915 877	**10.** 210 145	**12.** 609 539

Set III (3 minutes)

1. 896 599	**3.** 607 408	**5.** 700 510	**7.** 686 677	**9.** 987 866	**11.** 504 117
2. 283 101	**4.** 967 200	**6.** 910 368	**8.** 915 437	**10.** 810 354	**12.** 954 400

Set IV (3 minutes)

1. 8,293 2,010	**3.** 12,119 8,903	**5.** 14,011 4,277	**7.** 13,131 3,266	**9.** 13,030 4,599
2. 12,438 3,989	**4.** 12,064 4,699	**6.** 14,053 5,788	**8.** 13,286 5,599	**10.** 14,353 7,766

Set V (3 minutes)

1. 16,070 9,081	**3.** 19,000 9,764	**5.** 15,008 8,375	**7.** 18,070 9,895	**9.** 15,000 7,453
2. 14,110 7,986	**4.** 10,000 7,212	**6.** 10,607 8,898	**8.** 11,001 4,862	**10.** 14,107 6,048

GRADED PRACTICE EXERCISES IN MULTIPLICATION

Set I (6 in 2 minutes)

1.	293	3.	591	5.	471	7.	716	9.	823	11.	429
	2		3		4		2		3		5
2.	529	4.	458	6.	476	8.	683	10.	518	12.	637
	4		2		3		4		5		5

Set II (6 in 2 minutes)

1.	419	3.	738	5.	394	7.	375	9.	582	11.	715
	6		7		8		6		8		9
2.	369	4.	628	6.	519	8.	167	10.	482	12.	642
	9		6		7		8		9		7

Set III (6 in 5 minutes)

1.	375	3.	468	5.	516	7.	427	9.	291	11.	538
	48		84		73		19		84		62
2.	619	4.	872	6.	518	8.	472	10.	934	12.	693
	26		37		91		62		73		19

Set IV (6 in 5 minutes)

1.	608	3.	590	5.	708	7.	970	9.	807	11.	906
	97		68		54		79		86		45
2.	817	4.	649	6.	743	8.	509	10.	708	12.	906
	305		503		209		830		760		890

Set V (4 in 5 minutes)

1.	917	3.	728	5.	462	7.	643	9.	853	11.	915
	359		786		593		678		953		876
2.	$7.41	4.	$9.24	6.	$8.25	8.	$6.51	10.	$9.36	12.	$7.38
	2.41		8.79		1.42		7.98		4.12		9.87

GRADED PRACTICE EXERCISES IN DIVISION

Write the quotients only.

Set I (2 minutes)

	a	*b*	*c*	*d*	*e*	*f*
1.	20)60	21)63	23)46	41)84	32)96	12)48
2.	30)93	21)47	32)68	43)99	22)59	23)58
3.	82)246	41)205	92)184	43)129	51)308	83)249
4.	62)289	81)578	74)199	82)399	32)139	41)298

Set II (4 minutes)

1.	34)74	91)850	63)150	41)172	57)180	87)625
2.	32)290	87)610	53)480	77)625	48)150	43)270
3.	55)213	33)272	43)202	26)161	69)483	58)406
4.	38)152	53)401	14)70	96)380	13)112	15)90

Work the following examples carefully.

Set III (9 minutes)

	a	*b*	*c*	*d*	*e*
1.	31)671	21)483	16)176	32)672	23)483
2.	52)1,768	71)2,698	90)7,920	71)2,589	40)3,440
3.	14)294	51)2,499	94)1,400	42)2,226	53)2,332

Set IV (9 minutes)

	a	*b*	*c*	*d*	*e*
1.	31)930	81)1,655	81)7,290	62)1,875	12)248
2.	82)4,100	93)3,724	53)3,720	71)2,140	12)370
3	91)6,390	72)4,350	64)4,736	74)4,884	52)2,236

Set V (9 minutes)

1.	77)4,928	39)3,145	56)2,598	25)1,500	75)6,308
2.	17)1,394	54)3,599	33)1,597	91)9,022	61)4,819
3.	16)757	14)1,367	15)1,395	93)3,906	42)3,990

Set VI (10 minutes)

1.	34)7,174	57)6,099	49)14,398	18)15,200	57)16,099
2.	12)11,772	27)4,185	32)30,848	74)28,658	63)18,119
3.	16)11,968	37)9,546	46)32,614	85)62,900	77)63,187

Set VII (10 minutes)

	a	*b*	*c*	*d*
1.	184)36,432	648)34,992	567)92,370	327)94,360

	a	*b*	*c*
2.	$4.68)$987.58	$9.34)$752.17	$2.24)$275.06
3.	$1.31)$82.43	$7.12)$733.36	$.98)$697.76

COSTS OF A CANTATA

Washington School gave a Christmas Cantata. The sixth-grade teacher was on the business committee. She asked two girls to help her to keep the accounts.

1. Miss Towne bought material for costumes as follows:

27 yd. brown cambric....@ 15¢ $3\frac{1}{8}$ yd. muslin.....@ 22¢
$6\frac{1}{2}$ yd. white cambric....@ 15¢ $4\frac{1}{2}$ yd. green cambric....@ 15¢

Find the cost of each item and the total cost of the costumes.

2. Miss Holmes sent a bill for the following items:

1 telegram	$.56	Postage and insurance	$.24
1 telegram	.64	8 rolls of tinsel @ $.10	?
6 copies of "The Fairy's Conspiracy" @ $.60	?	1 roll of wire @ $.10	?
		6 yd. fairy curtain @ $.10	?

Find the amount of each item and the total bill.

3. How many tickets at 25 cents each must be sold to cover the expenses of the cantata?

HOW TO SOLVE PROBLEMS

After you have read each problem carefully, answer the following questions about it. Then solve the problem and check your work.

I. What am I asked to find in the problem?

II. What facts must I know to find this?

III. Am I told these facts in the problem?

IV. How can I find the facts that I must know in order to solve the problem?

V. What do I estimate the answer to be?

1. Lemons are advertised at 2 for 10¢. At this price, what must I pay for a dozen lemons?

2. Sadie Brown bought a pound of butter at 56¢ a pound, and one and one-half pounds of coffee at 40¢ a pound. What change will she receive if she gives the grocer two one-dollar bills?

3. A remnant of cloth, $\frac{1}{2}$ yard long, sold for $1.35. At this rate what was the price of a yard?

4. At a sale, all goods were marked down to $\frac{1}{2}$ the regular price. What must I pay for $4\frac{1}{2}$ yards of silk regularly priced at $4.80 a yard?

5. After Christmas, toys were sold at $\frac{1}{3}$ of the holiday price. What did Agnes pay for a doll that was marked $5.25 before Christmas?

6. Before I started on a trip, my speedometer read 8,222 miles. On my return it read 9,182 miles. I find that I used 80 gallons of gasoline on the trip. How many miles, on the average, did my car travel on a gallon of gasoline?

7. I bought 5 gallons of gasoline at 22¢, and 2 quarts of oil at 21¢. What change did I receive from a five-dollar bill?

8. On the average, Mr. Wilson uses 28 gallons of gasoline a month. What will he save in one month on his gasoline, if the price is reduced from 23¢ a gallon to $21\frac{1}{2}$¢ a gallon?

9. A man is paid 90¢ an hour for repairing cars. He spends $3\frac{3}{4}$ hours repairing one car and $2\frac{1}{4}$ hours repairing another. How much does he earn?

10. James and his father drove to Chicago, a distance of 210 miles, at an average rate of 20 miles an hour. They came back at an average rate of 30 miles an hour. How much longer did it take them to go than to return?

ESTIMATING COSTS

Sometimes it is not convenient to find the exact cost of a number of items because the numbers used are too large, or because they are not easy to work with mentally. For instance, if you are buying 6 pounds of butter at 49¢ a pound, you know that the cost will be about 6×50¢, since 49¢ is about 50¢. This is a quick way of checking a bill.

1. In estimating with the following prices, what numbers would be convenient to use?

\$.79 \$.98 \$7.96 \$11.75 \$198 \$29.50 \$3.06

Estimate mentally the cost of the following. Then check your estimate by doing the work on paper.

2. 8 crates of cherries at \$7.94 a crate.

3. 24 bushels of oats at 69¢ a bushel.

4. 12 pounds of butter at 51¢ a pound.

5. 6 yards of cloth at 98¢ a yard.

6. 29 loaves of bread at 9¢ a loaf.

7. 9 pounds of coffee at 51¢ a pound, and 21 loaves of bread at 14¢ a loaf.

READING EXERCISE IN PROBLEM SOLVING

Under each of the following problems there are five statements. Tell which of them are true and which are false.

1. *Eggs cost 48 cents a dozen. Mary buys 2 dozen. How much change should she receive from a dollar?*

a. Mary buys 3 dozen eggs.

b. The eggs cost 48 cents a dozen.

c. Divide to find the cost of the eggs.

d. Mary spent less than a dollar for the eggs.

e. I am to find what Mary spent for the eggs.

2. *Arthur spends 20 cents a day for lunch and 16 cents a day for street car fare. How much does he spend for car fare and lunches in five days?*

a. Each day Arthur spends 36 cents for car fare and lunch.

b. Arthur spends 16 cents for car fare in five days.

c. Arthur spends 20 cents a day for lunch.

d. In five days Arthur spends $5.00 for lunches and car fare.

e. Arthur spends more for street car fare than for lunch.

3. *Mary's mother bought 6 yards of cloth at 45 cents a yard for two dresses for Mary. Find the cost of the cloth for one dress.*

a. Mary's mother bought 45 yards of cloth.

b. She made two dresses with the cloth.

c. The cloth cost 45 cents a yard.

d. She needed three yards of cloth for one dress.

e. I am to find the cost of the cloth for the two dresses.

4. *What is the area of a field $\frac{7}{8}$ mile long and $\frac{3}{4}$ mile wide?*

a. Area means surface.

b. Area is the same as perimeter.

c. The field is longer than it is wide.

d. $\frac{7}{8} \times \frac{3}{4}$ will give the area.

e. The field is more than a mile long.

ESTIMATING ANSWERS

After each of the following examples, three numbers are written. First select the number which you think is about the correct answer; second, work the example; third, compare your estimate with the correct answer. How many of your estimates were correct?

1. $75 + 86 + 97 = 300, 200, 250.$
2. $\$37.96 - \$28.97 = \$10, \$9, \$8.$
3. $25 \times 48 = 800, 1{,}200, 1{,}600.$
4. $\$56.25 \div 25 = \$3.20, \$8.15, \$2.20.$
5. $3\frac{1}{2} + 2\frac{1}{4} + 7\frac{1}{2} = 12\frac{1}{4}, 13\frac{1}{4}, 14\frac{1}{4}.$
6. $374\frac{1}{8} - 356\frac{1}{4} = 30, 40, 50.$
7. $5\frac{1}{2} \times 36 = 150, 200, 300.$
8. $3\frac{1}{2} \times 6\frac{4}{7} = 18, 23, 36.$
9. $9 \div \frac{2}{3} = 10, 14, 22.$
10. $2\frac{1}{2} \div 5 = 2, \frac{1}{2}, 3\frac{1}{4}.$
11. $6\frac{2}{3} \div 3\frac{1}{3} = 2, 4, \frac{1}{2}.$
12. $\frac{9}{10} \div \frac{2}{5} = 1, \frac{1}{4}, 2.$
13. $43 \times 21 = 800, 900, 1{,}200.$
14. $4{,}012 \div 68 = 69, 46, 59.$
15. $\$4.80 + \$7.68 + \$9.47 = \$20, \$24, \$22.$
16. $\frac{3}{4} + \frac{7}{8} + \frac{9}{10} = 1, 1\frac{1}{2}, 2.$
17. $6\frac{4}{5} \times 9 = 46, 54, 58.$
18. $1{,}896 \div 28 = 90, 66, 82.$
19. $17\frac{1}{2} \div 5 = 2, 3\frac{1}{2}, 4\frac{1}{2}.$
20. $28 \times 67 = 1{,}896, 1{,}526, 1{,}286.$
21. $\$78.64 + \$97.69 + \$8.25 = \$300, \$175, \$125.$
22. $\frac{3}{8} \div \frac{3}{16} = \frac{1}{2}, \frac{7}{8}, 2.$
23. $4{,}285 \div 63 = 78, 69, 47.$
24. $\frac{1}{2} \times \frac{1}{4} \times \frac{1}{3} = \frac{1}{20}, 1, 3.$
25. $3\frac{1}{2} \div \frac{3}{4} = \frac{1}{4}, 5, 12.$

PRACTICE IN ESTIMATING ANSWERS

Accurate arithmetic workers estimate what the answer to a problem will be before doing the work. They check their answer by comparing it with their estimate. This prevents many foolish errors. Under each of the following problems are three estimates. First read each problem and estimate the answer. Then work the problems. In how many problems were your estimates the same as the correct answers?

1. The winner of a 500-mile automobile race traveled this distance in $5\frac{3}{4}$ hours. What was his average speed an hour?

a. 75 miles *b.* 90 miles *c.* 110 miles

2. In the Calhoun School there were 28 classrooms. There were 43 desks in each room on the average. How many desks were there in the school?

a. 500 *b.* 1,000 *c.* 2,000

3. The sixth-grade class deposited $29.48 in the school bank in September, $48.36 in October, and $38.49 in November. How much did the class deposit during the three months?

a. $115 *b.* $85 *c.* $220

4. Mr. Ford grew 8,168 bushels of corn and Mr. Curtis grew 5,976 bushels of corn. How much more corn than Mr. Curtis did Mr. Ford grow?

a. 3,000 bu. *b.* 2,500 bu. *c.* 2,000 bu.

5. Helen bought 5 pounds of butter at 49¢ a pound, 2 loaves of bread at 12¢ a loaf, and 10 pounds of sugar at $7\frac{1}{2}$¢ a pound. How much did she spend for all of these groceries?

a. $1.75 *b.* $3.50 *c.* $6.15

NAMING PROCESSES USED TO SOLVE PROBLEMS

What process would you use to solve each of the following problems? Write ***a*** for add, ***s*** for subtract, ***m*** for multiply, and ***d*** for divide.

Example: How do you find the cost of 25 pounds of meat at 34 cents a pound? ***m***

1. How do you find the price of a pound of coffee if $5\frac{1}{2}$ pounds cost $2.75?

2. How do you find the cost of $7\frac{1}{2}$ pounds of sugar at 8¢ a pound?

3. Mrs. Johnson needed 5 pounds of flour for bread. If she had only $3\frac{3}{4}$ pounds of flour, how many pounds more does she need?

4. Mr. Smith, a dairy farmer, sold 45 pounds of butter on Monday, 36 pounds on Tuesday, and 29 pounds on Wednesday. How many pounds of butter did he sell?

5. Mary bought 5 pounds of butter for $2.45. How do you find the price a pound?

6. In the Calhoun School there are 240 boys and 238 girls. How do you find the total number of children in the school?

7. Mr. Johnson sold 30 chickens that weighed in all 105 pounds. How do you find the average weight of the chickens?

8. A farmer sold 196 bushels of apples at $2.25 a bushel. How do you find how much he received for the apples?

9. How do you find the total weight of three boys, one weighing $84\frac{1}{2}$ pounds, one weighing $67\frac{3}{4}$ pounds, and one weighing $86\frac{3}{4}$ pounds?

PRACTICE IN NAMING MORE DIFFICULT QUOTIENTS

1. An army airplane reached a height of 28,640 feet. How many miles was this?

5.42+ 5,280)28,640.00 26,400 2 240 0 2 112 0 128 00 105 60 22 40	To find the first quotient figure think: 5 5)28 Since there will be five figures in the product of 5 × 5,280, write 5 over the 0 in 28,640. Since there is a remainder, carry the work to two decimal places. Sometimes the work is carried to three decimal places. Since there is a remainder after the work has been carried to two places, we write 5.42+. 28,640 ft. = 5.42 mi.

2. Mt. Everest is 29,141 feet in height. How many miles high is it?

Without pencil, name the first quotient figure in the following examples. Then work the examples.

3. 2,756)85,948 **5.** 1,574)36,845 **7.** 25,984)1,897,642

4. 3,000)184,632 **6.** 4,960)165,970 **8.** 11,250)328,597

9. On a large western farm 28,960 bushels of wheat were harvested from 1,280 acres. What was the average number of bushels an acre?

10. The Pacific Ocean is about 37,000 feet deep at its deepest point. How many miles deep is it at this point?

11. Divide 886,574 by 4,586.

BOYS' AND GIRLS' CLUBS

In all parts of the country there are boys' and girls' farm clubs. Reports of the work done by these clubs are collected by the United States Government. The results are given in the following table. Only the clubs with the largest numbers enrolled are included.

	No. Enrolled	No. Completing	Value of Products	Value for Each Person Completing
Crop				
Corn Clubs	35,317	17,293	$787,372	?
Cotton Clubs	8,830	4,459	438,899	?
Potato Clubs	11,448	7,830	319,825	?
Fruit Clubs	12,174	7,045	89,659	?
Live Stock				
Swine Clubs	51,611	28,313	1,425,002	?
Dairy Clubs	15,381	10,473	982,172	?
Sheep Clubs	2,204	1,524	89,265	?
Beef Clubs	6,139	4,453	498,398	?
Poultry Clubs	90,115	50,048	978,602	?
Food Preservation Clubs	81,960	48,325	825,514	?
Clothing Textile Clubs	148,721	94,560	647,042	?

1. Which club had the largest number enrolled? the largest number completing their projects? the largest total value of the products?

2. Make a list of the clubs, arranged in the order of the total value of the products. Begin with the club with the products of largest value.

3. For each kind of club, find the average value of the products for each person completing the work.

4. Rank the clubs in the order of the average value of the products. Begin your list with the name of the club having the product of largest average value.

5. How many boys and girls were enrolled in these clubs? How many completed the work? How many did not complete the work?

6. What was the total value of all of the products for all of the clubs?

7. In the food-preservation clubs, 2,454,665 quarts of food were canned. What was the average number of quarts for each person completing the work?

8. The clothing and textile clubs prepared 525,835 articles and garments. What was the average number of articles a person completing the work?

9. The average yield of potatoes an acre for boys' and girls' clubs was $110\frac{1}{2}$ bushels. The United States yield was $97\frac{1}{4}$ bushels. How much less than the yield for the clubs was the yield for the United States?

10. In a recent year the number enrolled in corn, potato, cotton, and fruit clubs was 56,725. Was this more or less than the total for the same clubs in the table on page 235?

A READING TEST

Supply the missing word in each of these sentences.

1. $\frac{3}{4}$ is a —— fraction.
2. $\frac{10}{9}$ is an —— fraction.
3. $1\frac{1}{2}$ is a —— number.
4. 4 is a —— number.
5. $\frac{1}{4}$ and $\frac{3}{4}$ are —— fractions.
6. $\frac{1}{4}$ and $\frac{1}{2}$ are —— fractions.
7. When $\frac{1}{4}$ is changed to $\frac{2}{8}$ it is changed to —— terms.
8. When $\frac{6}{8}$ is changed to $\frac{3}{4}$ it is reduced to —— terms.
9. Before $\frac{1}{2}$ and $\frac{1}{4}$ can be added, they must be changed to a —— denominator.
10. To change $\frac{1}{2}$ to $\frac{4}{8}$, multiply each term by ——.
11. To reduce $\frac{8}{10}$ to $\frac{4}{5}$, —— each term by 2.
12. Inverting $\frac{3}{5}$ gives ——.
13. Inverting $2\frac{2}{3}$ gives ——.
14. Inverting 5 gives ——.
15. Before unlike fractions can be added or subtracted, they must be changed to —— fractions.
16. When changed to an improper fraction, $3\frac{7}{8}$ is equal to ——.
17. $\div\frac{5}{9}$ means the same as $\times$ ——.
18. A common denominator for $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{5}$ is ——.
19. Give the steps in working this example:

$$16\tfrac{1}{8} - 3\tfrac{1}{2} = ?$$

20. Express the following in the simplest form:

$6\frac{6}{8}$ $9\frac{4}{2}$ $12\frac{2}{6}$ $16\frac{12}{10}$ $18\frac{33}{12}$

TESTS IN FRACTIONS

If you make any mistakes in these tests, practice the sets on pages 25 and 38 which contain examples similar to those which you worked incorrectly.

Addition of Fractions (10 minutes)

1. $\frac{5}{8}$ $\frac{1}{8}$ $\frac{3}{8}$	**3.** $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{8}$	**5.** $\frac{1}{3}$ $\frac{3}{4}$ $\frac{5}{6}$	**7.** $5\frac{4}{5}$ 6 $7\frac{1}{5}$	**9.** $5\frac{1}{6}$ $3\frac{1}{4}$ $2\frac{1}{2}$
2. $\frac{3}{5}$ $\frac{3}{5}$ $\frac{4}{5}$	**4.** $\frac{2}{3}$ $\frac{1}{6}$ $\frac{1}{12}$	**6.** $1\frac{1}{6}$ $2\frac{5}{6}$ $2\frac{1}{6}$	**8.** $6\frac{2}{3}$ $5\frac{2}{3}$ $9\frac{2}{3}$	**10.** $8\frac{1}{4}$ $7\frac{4}{5}$ $5\frac{5}{6}$

Subtraction of Fractions (10 minutes)

1. $\frac{9}{10}$ $\frac{3}{10}$	**3.** $\frac{3}{5}$ $\frac{3}{10}$	**5.** $\frac{3}{4}$ $\frac{2}{3}$	**7.** $5\frac{1}{3}$ $2\frac{2}{3}$	**9.** $9\frac{1}{4}$ $7\frac{5}{6}$
2. 2 $\frac{3}{4}$	**4.** 4 $3\frac{1}{3}$	**6.** $3\frac{1}{4}$ $1\frac{3}{4}$	**8.** $8\frac{1}{4}$ $3\frac{7}{8}$	**10.** $13\frac{2}{3}$ $8\frac{4}{5}$

Multiplication of Fractions (10 minutes)

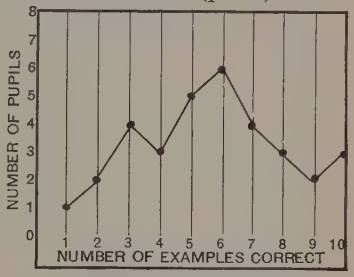
1. $\frac{2}{3} \times 8 =$	**5.** $3 \times 2\frac{1}{2} =$	**9.** $6\frac{2}{3} \times 72 =$
2. $2 \times \frac{5}{12} =$	**6.** $7\frac{1}{2} \times \frac{1}{5} =$	**10.** $\frac{4}{5} \times \frac{7}{8} \times 3\frac{1}{3} =$
3. $\frac{1}{3} \times \frac{1}{3} =$	**7.** $\frac{1}{8} \times 1\frac{1}{2} =$	**11.** $7\frac{7}{8} \times 616 =$
4. $\frac{3}{4} \times \frac{8}{9} =$	**8.** $2\frac{2}{3} \times 1\frac{1}{8} =$	**12.** $4\frac{1}{2} \times 7\frac{1}{6} \times 8 =$

Division of Fractions (10 minutes)

1. $4 \div \frac{1}{8} =$	**5.** $5\frac{1}{4} \div \frac{7}{10} =$	**9.** $7\frac{1}{2} \div 15 =$
2. $6 \div \frac{3}{4} =$	**6.** $6 \div 4\frac{1}{2} =$	**10.** $6\frac{2}{3} \div 3\frac{3}{4} =$
3. $\frac{1}{2} \div \frac{1}{6} =$	**7.** $3 \div 6\frac{2}{3} =$	**11.** $1\frac{1}{6} \div 7 =$
4. $\frac{3}{4} \div \frac{7}{8} =$	**8.** $7\frac{1}{5} \div 6 =$	**12.** $180 \div 6\frac{2}{3} =$

A GRAPH OF TEST SCORES

Miss Thompson made a graph of the scores made by the children in the test on addition of fractions (p. 20). This is the graph.



1. How many pupils had 1 example correct? 2 examples correct?

2. How many had 10 correct?

3. How many pupils had 5 or less examples correct?

4. How many pupils had 6 or more examples correct?

5. Which pupils do you think should do special work in addition of fractions?

6. Draw a graph for the following record of the class on the test in subtraction of fractions:

3 pupils solved 3 examples correctly
2 pupils solved 4 examples correctly
5 pupils solved 5 examples correctly
6 pupils solved 6 examples correctly
1 pupil solved 7 examples correctly
7 pupils solved 8 examples correctly
4 pupils solved 9 examples correctly
2 pupils solved 10 examples correctly

***7.** Make a graph of the record made by your class on the test in multiplication of fractions on page 20.

***8.** Make a graph of the record made by your class on the test in division of fractions.

***9.** Find the class average score and show it on your graph with a heavy line.

***10.** Make a graph of your own scores on the tests in fractions.

***11.** Do you think that all pupils below the class average should do special work?

HOW OUR FARM LAND IS USED

The Department of Agriculture makes a report each year showing the use that is made of the crop land in each of the states. The table below shows the fraction of the area of each state that is used for wheat, hay, and forage.

	Wheat	Hay and Forage	Part Used for Wheat, Hay, and Forage	Part Used for Other Purposes
Kansas	$\frac{1}{2}$	$\frac{1}{4}$	?	?
South Dakota	$\frac{1}{4}$	$\frac{1}{3}$	?	?
Idaho	$\frac{2}{5}$	$\frac{2}{5}$	?	?
Virginia	$\frac{1}{6}$	$\frac{1}{6}$	?	?

1. What fraction of the crop land in Kansas was used for wheat? for forage?

2. What fraction of the crop land was used for these two purposes in Kansas?

3. What fraction of the crop land was used for these two purposes in each of the other states?

4. If $\frac{3}{4}$ of the crop land in Kansas was used for wheat and forage, what fraction was used for other purposes?

5. What fraction of the land is used for other purposes in each of the states?

6. One year a Kansas farmer raised 636 bushels of wheat on a 24-acre field. What was the average number of bushels an acre?

7. One year the average number of bushels of wheat an acre in the United States was $12\frac{4}{5}$ bushels. A South Dakota farmer raised 525 bushels on 35 acres. How many bushels an acre more than the average did he raise?

DIFFICULTIES IN ADDITION OF FRACTIONS

Study the examples below before solving the practice exercises on pages 25 and 26. When you understand the work, copy the examples and work them yourself. Compare your work with the work below.

$\frac{1}{2} + \frac{3}{4} + \frac{1}{8} = ?$

$\frac{1}{2} = \frac{4}{8}$

$\frac{3}{4} = \frac{6}{8}$

$\frac{1}{8} = \frac{1}{8}$

$\frac{11}{8} = 1\frac{3}{8}$

Before these fractions can be added, they must be changed to a common denominator. The sum, $\frac{11}{8}$, an improper fraction, can be reduced to $1\frac{3}{8}$, by dividing the numerator, 11, by the denominator, 8. $\frac{11}{8} = 11 \div 8 = 1\frac{3}{8}$.

$2\frac{1}{3} + 3\frac{3}{4} + 5\frac{1}{2} = ?$

$2\frac{1}{3} = 2\frac{4}{12}$

$3\frac{3}{4} = 3\frac{9}{12}$

$5\frac{1}{2} = 5\frac{6}{12}$

$10\frac{19}{12} = 10 + 1\frac{7}{12} = 11\frac{7}{12}$

The fractions must be changed to a common denominator. The sum of the fractions, $10\frac{19}{12}$, must be expressed in simplest form, as shown at the left.

Find the common denominator for each of the following pairs of fractions. If you cannot give the common denominator at sight, you can find a common denominator for each pair by multiplying the denominators of the fractions.

	a	*b*	*c*	*d*	*e*
1.	$\frac{1}{2}, \frac{1}{4}$	$\frac{1}{3}, \frac{5}{6}$	$\frac{1}{2}, \frac{7}{8}$	$\frac{3}{8}, \frac{3}{4}$	$\frac{1}{2}, \frac{1}{10}$
2.	$\frac{1}{2}, \frac{1}{3}$	$\frac{1}{4}, \frac{1}{3}$	$\frac{1}{5}, \frac{1}{4}$	$\frac{1}{3}, \frac{1}{8}$	$\frac{1}{3}, \frac{1}{5}$
3.	$\frac{1}{4}, \frac{1}{6}$	$\frac{5}{6}, \frac{7}{8}$	$\frac{1}{4}, \frac{1}{10}$	$\frac{1}{6}, \frac{7}{10}$	$\frac{3}{8}, \frac{3}{10}$

Reduce each of the following to simplest form:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
4.	$\frac{9}{12}$	$\frac{16}{24}$	$\frac{8}{12}$	$\frac{15}{20}$	$\frac{18}{24}$	$\frac{15}{50}$	$\frac{16}{28}$	$\frac{4}{4}$
5.	$\frac{11}{4}$	$\frac{9}{3}$	$\frac{2}{2}$	$\frac{16}{7}$	$\frac{12}{8}$	$\frac{14}{6}$	$\frac{18}{3}$	$\frac{14}{7}$
6.	$8\frac{2}{2}$	$7\frac{4}{4}$	$5\frac{9}{6}$	$7\frac{11}{4}$	$15\frac{6}{3}$	$3\frac{3}{2}$	$8\frac{5}{3}$	$7\frac{8}{8}$

AN ARITHMETIC VOCABULARY TEST

In the fifth grade you learned many words frequently used in arithmetic. This test will help you to find how many of the words you remember.

1. The answer in an addition example is called the .....

2. The answer in a multiplication example is called the .....

3. The answer in a division example is called the .....

4. $\frac{1}{2}$ is called a ..... fraction.

5. $\frac{7}{4}$ is called an ..... fraction.

6. $3\frac{3}{4}$ is a ..... number.

7. $\frac{1}{4}$ and $\frac{3}{4}$ are a pair of ..... fractions.

8. $\frac{2}{3}$ and $\frac{1}{2}$ are a pair of ..... fractions.

9. In the fraction $\frac{4}{5}$, 4 is the .....

10. In the fraction $\frac{7}{8}$, 8 is the .....

11. 15 is a ..... denominator of $\frac{1}{3}$ and $\frac{1}{5}$.

12. $\frac{3}{4}$ is the ..... form of $\frac{4}{3}$.

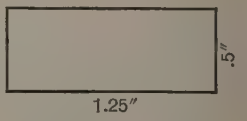
13. Changing $\frac{1}{4}$ to $\frac{2}{8}$ is called .....

14. Changing $\frac{8}{12}$ to $\frac{2}{3}$ is called .....

15. The numbers 2 and 3 in $\frac{2}{3}$ are called the ..... of the fraction.

16. A square inch is a unit of ..... .

17. The figure at the right is a .....



18. In the number, 7.5, the (.) is called the .....

19. The number, .5, is a ..... fraction.

20. A cubic inch is a unit of .....

21. The distance around a flat surface is its .....

PRACTICE IN CHANGING THE FORM OF A NUMBER

What is the missing numerator in each case?

1. $1\frac{1}{2} = 1\frac{\quad}{4} = 1\frac{\quad}{6} = 1\frac{\quad}{8} = 1\frac{\quad}{10} = 1\frac{\quad}{12} = 1\frac{\quad}{16}$
2. $1\frac{3}{4} = 1\frac{\quad}{8} = 1\frac{\quad}{16} = 1\frac{\quad}{12} = 1\frac{\quad}{24}$
3. $1\frac{1}{4} = \frac{\quad}{4} = \frac{\quad}{8} = \frac{\quad}{16} = \frac{\quad}{12} = \frac{\quad}{24}$
4. $1\frac{1}{2} = \frac{\quad}{2} = \frac{\quad}{4} = \frac{\quad}{6} = \frac{\quad}{10} = \frac{\quad}{24}$
5. $4\frac{2}{5} = 3\frac{\quad}{5} = 3\frac{\quad}{10} = 3\frac{\quad}{20} = 3\frac{\quad}{15} = 3\frac{\quad}{100}$
6. $2\frac{1}{2} = 1\frac{\quad}{2} = 1\frac{\quad}{4} = 1\frac{\quad}{6} = 1\frac{\quad}{8} = 1\frac{\quad}{10}$
7. $5\frac{3}{2} = 6\frac{\quad}{2}$
8. $6\frac{8}{5} = 7\frac{\quad}{5}$
9. $7\frac{4}{3} = 8\frac{\quad}{3}$
10. $9\frac{5}{4} = 10\frac{\quad}{4}$
11. $7\frac{11}{8} = 8\frac{\quad}{8}$
12. $6\frac{9}{6} = 7\frac{\quad}{6} = 7\frac{\quad}{2}$
13. $5\frac{3}{2} = 5\frac{\quad}{4} = 5\frac{\quad}{6} = 5\frac{\quad}{8}$
14. $6\frac{5}{4} = 6\frac{\quad}{16} = 6\frac{\quad}{8} = 6\frac{\quad}{12}$
15. $4\frac{1}{3} = 3\frac{\quad}{6} = 3\frac{\quad}{9}$
16. $8\frac{1}{2} = 7\frac{\quad}{4} = 7\frac{\quad}{8}$
17. $9\frac{10}{8} = 10\frac{\quad}{8} = 10\frac{\quad}{4}$
18. $6\frac{5}{3} = 7\frac{\quad}{3}$

Reduce these numbers to simplest form.

19. $6\frac{5}{4} =$
20. $8\frac{9}{6} =$
21. $6\frac{6}{4} =$
22. $8\frac{12}{8} =$
23. $1\frac{14}{7} =$
24. $6\frac{4}{2} =$
25. $6\frac{8}{12} =$
26. $9\frac{7}{5} =$
27. $8\frac{15}{10} =$
28. $\frac{17}{4} =$
29. $\frac{28}{12} =$
30. $\frac{75}{125} =$

PRACTICE IN ADDITION OF FRACTIONS

Practice these sets of addition examples in fractions until you can find the answers quickly and accurately. Keep a record of your time on three trials of each set.

Set I

$$\begin{array}{r} \frac{1}{4} \\ \frac{1}{4} \\ \hline \end{array} \qquad \begin{array}{r} \frac{1}{3} \\ \frac{2}{3} \\ \hline \end{array} \qquad \begin{array}{r} \frac{3}{5} \\ \frac{4}{5} \\ \hline \end{array} \qquad \begin{array}{r} \frac{5}{6} \\ \frac{5}{6} \\ \hline \end{array} \qquad \begin{array}{r} \frac{2}{3} \\ \frac{2}{3} \\ \frac{2}{3} \\ \hline \end{array} \qquad \begin{array}{r} \frac{3}{4} \\ \frac{1}{4} \\ \frac{1}{4} \\ \hline \end{array} \qquad \begin{array}{r} \frac{5}{8} \\ \frac{7}{8} \\ \frac{5}{8} \\ \hline \end{array}$$

$\frac{3}{8} + \frac{1}{8} =$ $\qquad \frac{7}{10} + \frac{8}{10} =$ $\qquad \frac{9}{10} + \frac{1}{10} =$ $\qquad \frac{7}{9} + \frac{7}{9} + \frac{5}{9} =$

Set II

$\frac{3}{4} + \frac{1}{8}$ $\quad$ $\frac{5}{6} + \frac{1}{3}$ $\quad$ $\frac{4}{5} + \frac{3}{4}$ $\quad$ $\frac{5}{12} + \frac{1}{4}$ $\quad$ $\frac{9}{10} + \frac{3}{5}$ $\quad$ $\frac{2}{3} + \frac{3}{8}$ $\quad$ $\frac{2}{3} + \frac{4}{5} + \frac{3}{8}$

$\frac{5}{6} + \frac{1}{8} =$ $\quad$ $\frac{5}{6} + \frac{1}{4} + \frac{7}{8} =$ $\quad$ $\frac{3}{4} + \frac{5}{6} =$ $\quad$ $\frac{1}{6} + \frac{7}{8} =$

Set III

$1\frac{1}{2} + \frac{1}{2}$ $\quad$ $2\frac{1}{4} + 3\frac{1}{4}$ $\quad$ $5\frac{7}{8} + 6\frac{1}{8}$ $\quad$ $4\frac{5}{9} + 3\frac{7}{9}$ $\quad$ $6\frac{4}{5} + 3\frac{3}{5}$ $\quad$ $8\frac{1}{3} + 6\frac{2}{3} + 7\frac{1}{3}$ $\quad$ $9\frac{7}{10} + 8\frac{6}{10} + 3\frac{7}{10}$

$4 + \frac{1}{5} =$ $\quad$ $2\frac{2}{3} + 3 + 1\frac{2}{3} =$ $\quad$ $8 + \frac{1}{4} + 3\frac{3}{4} =$ $\quad$ $1\frac{1}{4} + 4 =$

Set IV

$6\frac{2}{3} + \frac{1}{4}$ $\quad$ $\frac{7}{8} + 9\frac{3}{4}$ $\quad$ $3\frac{1}{5} + 2\frac{2}{3}$ $\quad$ $7\frac{1}{2} + 4\frac{5}{6}$ $\quad$ $4\frac{3}{8} + 2\frac{5}{6}$ $\quad$ $9\frac{3}{4} + 4\frac{1}{10}$ $\quad$ $\frac{1}{3} + 6\frac{3}{4} + 4\frac{5}{6}$

$3\frac{1}{5} + 2\frac{2}{5} + 4\frac{2}{5} =$ $\quad$ $4\frac{1}{6} + 5\frac{11}{12} =$ $\quad$ $3\frac{1}{3} + 2\frac{5}{6} =$

Set V

$\frac{4}{5} + \frac{1}{5}$ $\quad$ $\frac{5}{6} + 7\frac{5}{6}$ $\quad$ $4\frac{1}{2} + 6\frac{7}{8}$ $\quad$ $\frac{4}{5} + \frac{9}{10}$ $\quad$ $\frac{8}{15} + 7\frac{2}{5}$ $\quad$ $7\frac{7}{8} + 8\frac{1}{4} + 5\frac{5}{6}$ $\quad$ $2\frac{2}{3} + 4 + 9\frac{7}{8}$

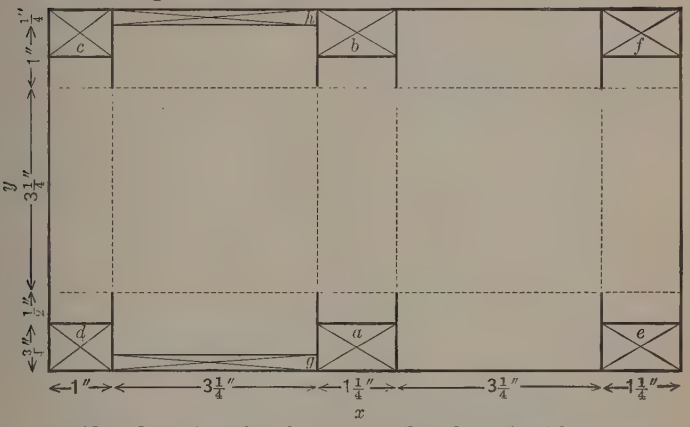
$5\frac{1}{4} + 6\frac{1}{12} =$ $\quad$ $5\frac{9}{10} + 3\frac{1}{3} =$ $\quad$ $8\frac{5}{6} + 2\frac{1}{3} =$ $\quad$ $8\frac{1}{4} + 6\frac{1}{8} =$

Set VI

$\frac{1}{4} + \frac{1}{2} + \frac{7}{8}$ $\quad$ $\frac{1}{3} + \frac{3}{4} + \frac{5}{6}$ $\quad$ $1\frac{1}{2} + 3 + 2\frac{1}{2}$ $\quad$ $1\frac{3}{4} + 2\frac{1}{2} + 3\frac{1}{4}$ $\quad$ $7\frac{7}{8} + 6\frac{3}{4} + 5\frac{1}{2}$ $\quad$ $9\frac{4}{5} + 6\frac{1}{2} + 8\frac{9}{10}$ $\quad$ $4\frac{2}{3} + 3\frac{1}{2} + 7\frac{7}{8}$

A CONSTRUCTION PROBLEM

Here is a pattern for a box.



1. How long is side x? **2.** How long is side y?

3. Draw a rectangle on a piece of heavy paper, using the dimensions of the pattern. Cut out the rectangle.

4. What are the dimensions of a, b, c, d, e, f, g, and h?

5. Draw these rectangles as in the plan. Draw the dotted lines as in the pattern. Draw the solid lines as they are drawn in the pattern.

6. Cut out the rectangles in the four corners along the solid lines.

7. Cut the solid lines in the center of the pattern. Be careful not to cut farther than the dotted line.

8. Cut off rectangles a and b.

9. Cut off rectangles g and h.

10. Fold carefully along all of the dotted lines.

11. Now make the box.

PROBLEMS WITH TWO QUESTIONS

You must find the answer to the first question in each of these problems before you can answer the second question.

1. Julia wishes to make 3 dresses. She needs $3\frac{1}{2}$ yards of cloth for each dress.

a. How much cloth does she need in all?

b. How much will the cloth cost at 40 cents a yard?

2. Helen worked $3\frac{1}{2}$ hours for Mrs. Johnson on Saturday and $2\frac{3}{4}$ hours on Friday.

a. How many hours did she work in all?

b. How much did she earn if she was paid 32 cents an hour?

3. One day Harry picked $2\frac{1}{2}$ bushels of apples. He sold $1\frac{1}{2}$ bushels to Mr. Dreiman, the grocer.

a. How many bushels of apples did Harry then have?

b. The next day Harry picked 3 bushels of apples. How many bushels of apples did he then have?

4. Jack bought 10 pounds of sugar for 75 cents.

a. How much did he pay a pound for the sugar?

b. At that rate what would 8 pounds cost?

5. Henry had a board $4\frac{1}{2}$ yards in length. He cut the board into three pieces of equal length.

a. How long was each piece of board?

b. Express the length of each piece in inches.

6. Helen sold three large boxes of apples. One weighed 45 pounds, one weighed 38 pounds, and one weighed 50 pounds.

a. How much was their total weight?

b. Find their average weight.

SOME INDIVIDUAL GROWTH RECORDS

Here are the height and weight records of four children for a period of 18 weeks.

	Polly O.		John H.		Dorothy H.		Charles W.	
	Height (Inches)	*Weight* (Pounds)	*Height* (Inches)	*Weight* (Pounds)	*Height* (Inches)	*Weight* (Pounds)	*Height* (Inches)	*Weight* (Pounds)
Oct. 23...	$47\frac{1}{4}$	$52\frac{1}{2}$	$47\frac{1}{4}$	$53\frac{3}{4}$	$53\frac{1}{4}$	$72\frac{1}{4}$	$53\frac{1}{4}$	72
Dec. 5...	$47\frac{1}{2}$	$53\frac{1}{4}$	$47\frac{1}{2}$	$54\frac{1}{2}$	$53\frac{1}{4}$	$73\frac{1}{2}$	$53\frac{1}{2}$	$72\frac{3}{4}$
Feb. 27...	48	$54\frac{1}{2}$	$47\frac{1}{2}$	56	$53\frac{1}{2}$	76	54	$74\frac{1}{2}$

1. Which child made the largest growth in height between October 23 and February 27?

2. Which child made the largest total growth in weight?

3. Rank the children in the order of the amount of total gain in height. Make a list of the names, beginning with the child that made the largest gain. Give the gains.

4. Rank the children in the order of the amount of gain in weight. Give the gain for each child. Were the ranks for both height and weight the same?

***5.** Find the amount of growth in height and weight for each child during each interval. Use the form of the table below to make the report of the results.

RECORD OF GROWTHS

Periods	Polly		John		Dorothy		Charles	
	Height	*Weight*	*Height*	*Weight*	*Height*	*Weight*	*Height*	*Weight*
Oct. to Dec.....								
Dec. to Feb.....								
Total Growth...								

DIFFICULTIES IN SUBTRACTION OF FRACTIONS

The examples below contain the chief difficulties in subtraction of fractions. Study them carefully before you begin work on the practice exercises (pp. 31–32).

1. $3\frac{1}{2} - 1\frac{1}{6} = ?$

$3\frac{1}{2} = 3\frac{3}{6}$

$1\frac{1}{6} = 1\frac{1}{6}$

$2\frac{2}{6} = 2\frac{1}{3}$

First change the fractions to a common denominator, than subtract. Reduce the fraction in the answer to lowest terms.

2. $7 - 2\frac{1}{2} = ?$

$7 = 6\frac{2}{2}$

$2\frac{1}{2} = 2\frac{1}{2}$

$4\frac{1}{2}$

First change 7 to $6\frac{2}{2}$.
The example then becomes: $6\frac{2}{2} - 2\frac{1}{2}$.

3. $5\frac{1}{4} - 2\frac{3}{4} = ?$

$5\frac{1}{4} = 4\frac{5}{4}$

$2\frac{3}{4} = 2\frac{3}{4}$

$2\frac{2}{4} = 2\frac{1}{2}$

Since $\frac{3}{4}$ cannot be subtracted from $\frac{1}{4}$, change $5\frac{1}{4}$ to $4\frac{5}{4}$. Remember that $5\frac{1}{4}$ equals $4 + 1\frac{1}{4} = 4\frac{5}{4}$.
Then subtract.

4. $6\frac{1}{2} - 1\frac{7}{8} = ?$

$6\frac{1}{2} = 6\frac{4}{8} = 5\frac{12}{8}$

$1\frac{7}{8} = 1\frac{7}{8} = 1\frac{7}{8}$

$4\frac{5}{8}$

First change the fractions to a common denominator. Since $\frac{7}{8}$ cannot be subtracted from $\frac{4}{8}$, change $6\frac{4}{8}$ to $5\frac{12}{8}$.
Then subtract.

5. Copy examples **1** to **4** and work them with your books closed. Compare your work with the work above.

6. Supply the missing numerators in the following:

a. $6 = 5\frac{\quad}{2}$, $5\frac{\quad}{4}$, $5\frac{\quad}{6}$, $5\frac{\quad}{3}$, $5\frac{\quad}{8}$.

b. $6\frac{1}{2} = 5\frac{\quad}{2}$; *d.* $7\frac{1}{4} = 6\frac{\quad}{4}$; *f.* $8\frac{2}{3} = 7\frac{\quad}{3}$; *h.* $5\frac{3}{5} = 4\frac{\quad}{5}$

c. $7\frac{1}{4} = 6\frac{\quad}{8}$; *e.* $8\frac{2}{5} = 7\frac{\quad}{10}$; *g.* $6\frac{1}{2} = 5\frac{\quad}{6}$; *i.* $9\frac{2}{3} = 8\frac{\quad}{6}$

7. Give each step in working this example:

$8\frac{1}{3} - 2\frac{5}{6} = ?$

ZERO DIFFICULTIES IN SUBTRACTION OF FRACTIONS

1. Harry had $5\frac{3}{4}$ bushels of walnuts. He sold all but $1\frac{3}{4}$ bushels. How many bushels did he sell?

	Think: $5\frac{3}{4}$ bu. $-1\frac{3}{4}$ bu. = ?
$5\frac{3}{4}$ bu.	$\frac{3}{4} - \frac{3}{4} = 0$. Do not write zero.
$-1\frac{3}{4}$ bu.	$5 - 1 = 4$. Write 4.
4 bu.	Harry sold 4 bu. of walnuts.

Some of the examples below contain zero difficulties in subtraction. Work them carefully. If you make any mistakes, be sure that you find why your work is incorrect.

2.	$4\frac{2}{3}$	**8.**	7	**14.**	$8\frac{2}{3}$	**20.**	$7\frac{1}{4}$	**26.**	$2\frac{5}{8}$	**32.**	9
	$\frac{1}{3}$		$\frac{1}{3}$		$\frac{2}{3}$		$\frac{3}{4}$		$2\frac{1}{8}$		$3\frac{4}{5}$
3.	$7\frac{1}{5}$	**9.**	$6\frac{1}{2}$	**15.**	$4\frac{5}{6}$	**21.**	4	**27.**	$\frac{1}{4}$	**33.**	$8\frac{1}{4}$
	$\frac{3}{5}$		3		$\frac{1}{3}$		$3\frac{7}{12}$		$\frac{2}{8}$		$7\frac{3}{4}$
4.	4	**10.**	$3\frac{7}{8}$	**16.**	$\frac{1}{8}$	**22.**	1	**28.**	$5\frac{4}{5}$	**34.**	$7\frac{1}{4}$
	$1\frac{1}{8}$		$\frac{1}{2}$		$\frac{1}{8}$		$\frac{7}{8}$		$2\frac{4}{5}$		$\frac{2}{5}$
5.	$7\frac{5}{6}$	**11.**	$4\frac{1}{4}$	**17.**	$9\frac{3}{5}$	**23.**	$1\frac{1}{10}$	**29.**	$7\frac{1}{2}$	**35.**	$19\frac{1}{2}$
	$\frac{1}{6}$		$\frac{5}{8}$		$8\frac{4}{5}$		$\frac{4}{5}$		$5\frac{4}{8}$		$18\frac{2}{3}$
6.	$9\frac{7}{8}$	**12.**	$3\frac{1}{3}$	**18.**	$1\frac{1}{2}$	**24.**	$13\frac{1}{4}$	**30.**	$1\frac{5}{6}$	**36.**	$\frac{1}{7}$
	$9\frac{3}{4}$		$3\frac{1}{3}$		$\frac{5}{6}$		$12\frac{5}{8}$		$1\frac{1}{2}$		$\frac{1}{7}$
7.	$19\frac{1}{8}$	**13.**	$8\frac{1}{2}$	**19.**	$8\frac{1}{2}$	**25.**	$2\frac{1}{6}$	**31.**	$2\frac{3}{8}$	**37.**	$6\frac{3}{8}$
	19		$\frac{2}{3}$		$8\frac{1}{3}$		$\frac{2}{3}$		$\frac{1}{3}$		$4\frac{1}{8}$

38. Mrs. Smith had a piece of cloth $8\frac{1}{4}$ yards in length. She cut off a piece $3\frac{1}{4}$ yards long. How long was the remaining piece of cloth?

PRACTICE IN SUBTRACTION OF FRACTIONS

Practice these sets of subtraction examples until you can find the answers quickly and accurately. Keep a record for three trials of the time in which you can complete each set.

Set I

$\frac{4}{5}$	$\frac{3}{4}$	$\frac{11}{15}$	1	$\frac{7}{8}$	3	8
$\frac{1}{5}$	$\frac{1}{4}$	$\frac{2}{15}$	$\frac{2}{3}$	$\frac{7}{8}$	$1\frac{2}{3}$	$2\frac{2}{3}$

Set II

$\frac{4}{5}$	$\frac{2}{3}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{7}{8}$
$\frac{1}{10}$	$\frac{1}{4}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$

Set III

$3\frac{7}{8}$	$5\frac{5}{6}$	$2\frac{3}{4}$	$8\frac{3}{5}$	$4\frac{9}{10}$	$9\frac{3}{8}$	$5\frac{11}{12}$
$\frac{1}{8}$	$1\frac{1}{6}$	$2\frac{1}{4}$	$8\frac{1}{5}$	$2\frac{7}{10}$	$7\frac{1}{8}$	$4\frac{5}{12}$

Set IV

$7\frac{1}{8}$	$6\frac{5}{9}$	$4\frac{1}{4}$	$8\frac{1}{3}$	$18\frac{3}{5}$	$14\frac{11}{15}$	$6\frac{1}{6}$
$\frac{3}{8}$	$2\frac{7}{9}$	$3\frac{3}{4}$	$7\frac{2}{3}$	$9\frac{4}{5}$	$9\frac{13}{15}$	$4\frac{5}{6}$

Set V

$7\frac{2}{3}$	$9\frac{7}{8}$	$7\frac{11}{12}$	$14\frac{4}{5}$	$9\frac{9}{10}$	$8\frac{1}{2}$	$7\frac{1}{4}$
$3\frac{1}{4}$	$6\frac{1}{2}$	$2\frac{1}{6}$	$14\frac{3}{8}$	$3\frac{1}{3}$	$6\frac{1}{3}$	$7\frac{1}{8}$

Set VI

$7\frac{1}{3}$	$7\frac{5}{6}$	$9\frac{1}{2}$	$12\frac{1}{3}$	$8\frac{7}{10}$	$4\frac{3}{4}$	$6\frac{3}{5}$
$4\frac{3}{4}$	$3\frac{11}{12}$	$8\frac{3}{4}$	$11\frac{5}{6}$	$7\frac{4}{5}$	$2\frac{5}{6}$	$2\frac{9}{10}$

Set VII

3	$6\frac{1}{2}$	$9\frac{1}{8}$	$17\frac{4}{5}$	$7\frac{4}{5}$	$9\frac{11}{12}$	$18\frac{1}{3}$
$1\frac{2}{3}$	$2\frac{1}{4}$	$8\frac{1}{3}$	$2\frac{9}{10}$	$1\frac{1}{10}$	$9\frac{3}{4}$	$9\frac{7}{8}$

D

DIFFICULTIES IN MULTIPLICATION OF FRACTIONS

Study the following examples carefully before beginning the practice exercises on page 35. When you think you understand the work, copy the examples and solve them. Compare your work with the work below.

1. $7 \times \frac{1}{8} = ?$

$$7 \times \frac{1}{8} = \frac{7 \times 1}{8} = \frac{7}{8}$$

2. $\frac{3}{4} \times 2 = ?$

$$\frac{3}{4} \times 2 = \frac{3 \times 2}{4} = \frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2}$$

When multiplying a fraction and a whole number, multiply the numerator of the fraction by the whole number. Place the product over the denominator. Reduce the result to simplest form.

3. $\frac{3}{4} \times \frac{5}{7} = ?$

$$\frac{3}{4} \times \frac{5}{7} = \frac{3 \times 5}{4 \times 7} = \frac{15}{28}$$

4. $\frac{4}{5} \times \frac{5}{16} = ?$

$$\frac{\cancel{4}^{1}}{\cancel{5}_{1}} \times \frac{\cancel{5}^{1}}{\cancel{16}_{4}} = \frac{1 \times 1}{1 \times 4} = \frac{1}{4}$$

When multiplying two fractions, multiply the two numerators together to find the numerator of the answer and the two denominators to find the denominator of the answer. Use cancellation when possible.

5. $2\frac{1}{2} \times 3\frac{1}{2} = ?$

$$\frac{5}{2} \times \frac{7}{2} = \frac{5 \times 7}{2 \times 2} = \frac{35}{4} = 8\frac{3}{4}$$

In multiplying mixed numbers, change them to improper fractions and multiply.

6. Show how cancellation can be used in working this example: $\frac{3}{4} \times 1\frac{1}{3} \times \frac{1}{2}$.

7. What does three-fourths of a $1\frac{1}{2}$-pound package of spices weigh?

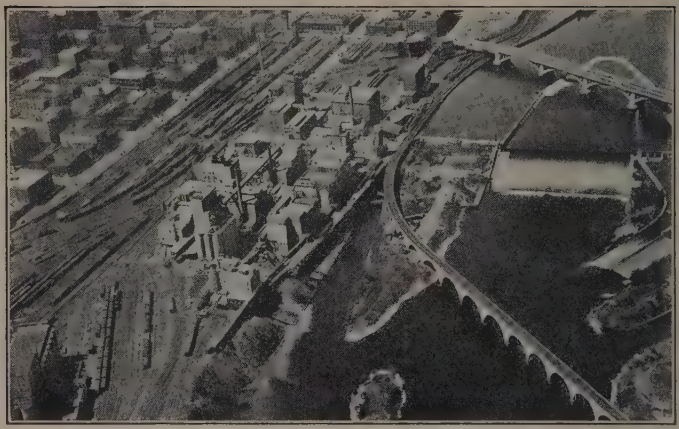
Think: $\frac{3}{4}$ of $1\frac{1}{2}$ lb. = ? Remember that "of" means ($\times$).

$\frac{3}{4}$ of $1\frac{1}{2}$ lb. $= \frac{3}{4} \times 1\frac{1}{2} = \frac{3}{4} \times \frac{3}{2} = \frac{9}{8} = 1\frac{1}{8}$ lb.

8. Reduce the following to improper fractions:

$3\frac{1}{2}$, $7\frac{1}{4}$, $5\frac{2}{3}$, $6\frac{7}{8}$, $7\frac{3}{4}$, $5\frac{2}{5}$, $1\frac{1}{6}$, $3\frac{1}{3}$.

D



THE OUTPUT OF ONE FLOUR MILL

1. In one of the great flour mills at Minneapolis 36,000 barrels of flour are manufactured a day. How many pounds of flour is this? (196 lb. = 1 bbl.)

2. Four and three-fourths bushels of wheat are required for one barrel of flour. How many bushels of wheat are required for the mill for one day?

3. The average yield of wheat is about 15 bushels an acre. How many acres will produce enough wheat for this flour mill for a day? for a week (6 days)? for a year?

4. How many 160-acre farms are required to supply the wheat for one day's production? one week's production? one year's production?

5. Wheat weighs 60 pounds a bushel. Find the weight of the wheat required for one barrel of flour. How much more than the weight of the flour is the weight of the wheat?

6. A car load of wheat averages about 1,200 bushels. How many car loads of wheat are used a day?

7. About 270 one-pound loaves of bread may be made from one barrel of flour. Find the number of one-pound loaves that can be made from the flour produced in one day by this mill.

8. The average value of a bushel of wheat exported from the United States in a recent year was $1.43. At this rate what was the value of the wheat required to make a barrel of flour?

***9.** If a barrel of flour cost a baker $9.75, what was the value of the flour used to make a one-pound loaf of bread?

***10.** Which is cheaper, to buy flour by the barrel at $9.80 or by the 49-pound sack at $2.52?

PRACTICE IN MULTIPLICATION OF FRACTIONS

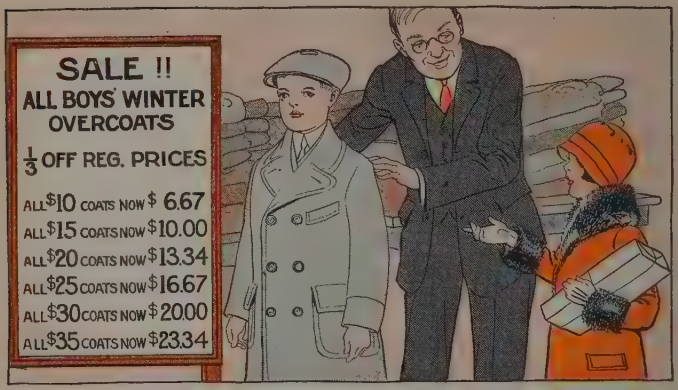
Practice these sets of multiplication examples until you can find the answers quickly and accurately.

Set I

	a	*b*	*c*	*d*
1.	$\frac{1}{3} \times 2 =$	$\frac{1}{4} \times 3 =$	$\frac{7}{8} \times 4 =$	$\frac{4}{5} \times 10 =$
2.	$\frac{8}{9} \times 3 =$	$3 \times \frac{1}{4} =$	$4 \times \frac{1}{5} =$	$7 \times \frac{2}{3} =$
3.	$\frac{1}{4} \times \frac{1}{4} =$	$\frac{1}{3} \times \frac{2}{3} =$	$\frac{7}{8} \times \frac{3}{4} =$	$\frac{4}{5} \times \frac{5}{6} =$
4.	$\frac{8}{9} \times \frac{3}{4} =$	$\frac{2}{4} \times \frac{3}{4} =$	$\frac{4}{9} \times \frac{3}{8} =$	$\frac{9}{10} \times \frac{5}{6} =$

Set II

1.	$2\frac{1}{2} \times 2 =$	$3\frac{1}{3} \times 3 =$	$4\frac{1}{4} \times 5 =$	$7\frac{1}{8} \times 6 =$
2.	$2\frac{1}{3} \times 5 =$	$3 \times 6\frac{1}{4} =$	$9 \times 8\frac{1}{10} =$	$12 \times 3\frac{2}{3} =$
3.	$2\frac{1}{2} \times \frac{1}{4} =$	$7\frac{1}{3} \times \frac{2}{3} =$	$5\frac{5}{6} \times \frac{5}{7} =$	$9\frac{1}{4} \times \frac{4}{5} =$
4.	$7\frac{1}{5} \times \frac{10}{27} =$	$\frac{7}{9} \times 3\frac{3}{5} =$	$\frac{4}{5} \times 6\frac{1}{4} =$	$\frac{2}{3} \times 5\frac{1}{4} =$


SALE !!
ALL BOYS' WINTER OVERCOATS
1/3 OFF REG. PRICES
ALL $10 COATS NOW $ 6.67
ALL $15 COATS NOW $10.00
ALL $20 COATS NOW $13.34
ALL $25 COATS NOW $16.67
ALL $30 COATS NOW $20.00
ALL $35 COATS NOW $23.34

This advertisement appeared in a daily paper.

1. Check over the figures and see if exactly $\frac{1}{3}$ is taken off.

2. If $\frac{1}{3}$ is taken off the regular price, what fraction of the regular price is the sale price?

3. Albert bought a $25 overcoat at the advertised price. What change did he get from a twenty-dollar bill?

4. Albert noticed some handkerchiefs marked to sell at 35¢. If the handkerchiefs were regularly priced at 50¢; what was the reduction on 10 handkerchiefs?

5. How much will Albert save if he buys a half dozen 30¢ handkerchiefs at the sale price of $\frac{1}{3}$ off?

6. The merchant tells him that the neckties are priced at $\frac{1}{3}$ off. Make a table like the one above showing the regular and sale prices of neckties regularly priced at 50¢, 75¢; $1.00; $1.25; $1.50; and $2.00.

7. A store advertised its women's fall coats at $\frac{1}{4}$ off. The coats were marked at $12, $15, $18, $21, $30, and $54. Find the regular prices of these coats.

IMPORTANT POINTS ABOUT DIVISION OF FRACTIONS

It is easy to divide by fractions if you always remember to invert the divisor and then to multiply. Study the following work carefully.

1. How many pieces of ribbon $\frac{3}{4}$ yard long can be cut from a ribbon $4\frac{1}{2}$ yards long?

$4\frac{1}{2} \div \frac{3}{4} = ?$ $\frac{3}{2} \times \frac{2}{3} = 6$	Change $4\frac{1}{2}$ to an improper fraction. Change $\div$ to $\times$. Invert $\frac{3}{4}$. Then multiply.

2. Mary wishes to cut a ribbon $4\frac{1}{2}$ yards long into three equal pieces. How long will each piece be?

$4\frac{1}{2} \div 3 = ?$ $\frac{9}{2} \div \frac{3}{1} = \frac{3}{2} \times \frac{1}{3} = \frac{3}{2} = 1\frac{1}{2}$	Remember that 3 is the same as $\frac{3}{1}$. The inverted form of 3 or $\frac{3}{1}$ is $\frac{1}{3}$. Each piece will be $1\frac{1}{2}$ yards long.

3. Alice has 6 yards of ribbon which she wishes to cut into pieces $1\frac{1}{2}$ yards long. How many pieces will she have?

$6 \div 1\frac{1}{2} = ?$ $6 \div \frac{3}{2} = \overset{2}{\cancel{6}} \times \frac{2}{\cancel{3}} = 4$	Change $1\frac{1}{2}$ to an improper fraction. Then invert and multiply. Alice will have 4 pieces.

Supply the missing numbers in the following and find the answers:

4. $1\frac{1}{2} \div \frac{3}{4} = \frac{3}{2} \times \text{—} = ?$

5. $4\frac{1}{3} \div \frac{1}{3} = \frac{13}{3} \times \text{—} = ?$

6. $3 \div \frac{2}{3} = 3 \times \text{—} = ?$

7. $7\frac{1}{2} \div 2\frac{1}{2} = \frac{15}{2} \times \text{—} = ?$

8. $7\frac{1}{2} \div 5 = \frac{15}{2} \times \text{—} = ?$

9. $2\frac{1}{2} \div 10 = \frac{5}{2} \times \text{—} = ?$

10. $4\frac{4}{5} \div 6 = \frac{24}{5} \times \text{—} = ?$

11. $\frac{2}{3} \div \frac{2}{3} = \frac{2}{3} \times \text{—} = ?$

12. $\frac{7}{8} \div \frac{1}{8} = \frac{7}{8} \times \text{—} = ?$

13. $\frac{1}{2} \div \frac{3}{4} = \frac{1}{2} \times \text{—} = ?$

14. $6\frac{2}{3} \div 3\frac{1}{8} = \frac{20}{3} \times \text{—} = ?$

15. $8\frac{1}{3} \div 1\frac{2}{3} = \frac{25}{3} \times \text{—} = ?$

16. $1\frac{1}{3} \div 6 = \frac{4}{3} \times \text{—} = ?$

17. $5 \div 12\frac{1}{2} = 5 \times \text{—} = ?$

PRACTICE IN DIVISION OF FRACTIONS

Practice these sets of division examples until you can find the answers quickly and accurately. Keep a record of your time on three trials of each set.

Set I

	a	*b*	*c*	*d*
1.	$1 \div \frac{1}{2} =$	$3 \div \frac{2}{3} =$	$7 \div \frac{5}{6} =$	$6 \div \frac{2}{3} =$
2.	$3 \div \frac{1}{5} =$	$8 \div \frac{4}{5} =$	$16 \div \frac{7}{8} =$	$20 \div \frac{10}{11} =$

Set II

1.	$\frac{1}{4} \div \frac{1}{8} =$	$\frac{1}{3} \div \frac{5}{6} =$	$\frac{2}{3} \div \frac{3}{4} =$	$\frac{7}{8} \div \frac{1}{2} =$
2.	$\frac{1}{2} \div \frac{3}{4} =$	$\frac{9}{10} \div \frac{3}{5} =$	$\frac{4}{5} \div \frac{1}{2} =$	$\frac{15}{16} \div \frac{5}{5} =$

Set III

1.	$3\frac{1}{2} \div \frac{1}{4} =$	$4\frac{1}{2} \div \frac{3}{4} =$	$8\frac{2}{3} \div \frac{4}{5} =$	$4\frac{4}{5} \div \frac{6}{7} =$
2.	$2\frac{1}{2} \div \frac{1}{2} =$	$5\frac{1}{2} \div \frac{3}{4} =$	$3\frac{1}{3} \div \frac{1}{3} =$	$12\frac{1}{2} \div \frac{5}{6} =$

Set IV

1.	$4 \div 2\frac{1}{2} =$	$8 \div 2\frac{2}{3} =$	$7 \div 11\frac{1}{5} =$	$9 \div 3\frac{3}{7} =$
2.	$12 \div 6\frac{2}{3} =$	$5 \div 6\frac{1}{4} =$	$8 \div 3\frac{1}{3} =$	$2 \div 2\frac{2}{9} =$

Set V

1.	$6\frac{1}{2} \div 2\frac{1}{2} =$	$4\frac{2}{3} \div 9\frac{1}{3} =$	$6\frac{2}{3} \div 1\frac{1}{4} =$	$6\frac{1}{2} \div 9\frac{3}{4} =$
2.	$3\frac{1}{3} \div 6\frac{2}{3} =$	$7\frac{7}{8} \div 3\frac{1}{8} =$	$6\frac{2}{3} \div 3\frac{1}{3} =$	$1\frac{1}{2} \div 4\frac{1}{2} =$

Set VI

1.	$\frac{1}{2} \div 4 =$	$\frac{3}{4} \div 6 =$	$\frac{7}{8} \div 5 =$	$\frac{9}{10} \div 6 =$
2.	$\frac{1}{6} \div 2 =$	$\frac{5}{6} \div 5 =$	$\frac{11}{12} \div 2 =$	$\frac{14}{15} \div 7 =$

Set VII

1.	$3\frac{1}{2} \div 2 =$	$4\frac{1}{2} \div 3 =$	$6\frac{2}{3} \div 10 =$	$8\frac{1}{3} \div 5 =$
2.	$1\frac{7}{8} \div 5 =$	$12\frac{1}{2} \div 25 =$	$9\frac{3}{4} \div 13 =$	$13\frac{1}{3} \div 4 =$

Set VIII

1.	$3 \div \frac{2}{3} =$	$\frac{9}{10} \div 6 =$	$6\frac{2}{3} \div \frac{2}{3} =$	$9 \div 16\frac{2}{3} =$
2.	$5 \div 1\frac{2}{3} =$	$8\frac{7}{8} \div 4\frac{1}{2} =$	$\frac{1}{8} \div \frac{1}{16} =$	$1\frac{1}{9} \div 3\frac{1}{3} =$

ON A DAIRY FARM

Dick and Donald live on a dairy farm. Their father told them to weigh the milk that three of their cows gave for four days. This is the record the boys made:

	Molly	Sue	Daisy	Totals by Days
Monday	$24\frac{1}{4}$ lb.	$30\frac{1}{8}$ lb.	$25\frac{1}{2}$ lb.	?
Tuesday	$24\frac{1}{2}$ lb.	$31\frac{3}{4}$ lb.	$25\frac{1}{8}$ lb.	?
Wednesday	$23\frac{7}{8}$ lb.	31 lb.	$24\frac{3}{8}$ lb.	?
Thursday	$24\frac{1}{8}$ lb.	$31\frac{3}{8}$ lb.	$25\frac{1}{4}$ lb.	?
Totals		?	?	?

1. On what day did Molly give the most milk? Sue? Daisy?

2. How much more milk than Molly did Sue give on Monday? how much more than Daisy?

3. How much more than Molly did Daisy give on Monday?

4. Copy the boys' record and fill in the blanks.

5. What was the average yield of each cow a day during the four days?

6. If Molly gave as much milk each day for 7 days as she did on Tuesday, how many pounds would she give?

7. If Sue gave as much milk each day for 6 days as she gave on Thursday, how many pounds would she give?

8. There are 2 pounds of milk in a quart. How many quarts of milk did each of the cows yield on each of the four days? You can show this by making a table like the one for pounds, but write quarts for pounds.

FRACTION REVIEW

Use this table for review work with fractions. Do all of the work you can mentally.

I. Add the number in the last column at the right to the numbers in each row.

II. Subtract the number in the last column from the numbers in each row.

III. Multiply the numbers in each row by the number in the last column.

IV. Divide the numbers in each row by the number in the last column.

1.	$\frac{3}{8}$	$\frac{5}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{7}{8}$	$\frac{3}{4}$	$1\frac{1}{2}$	$2\frac{1}{4}$	$3\frac{3}{8}$	$\frac{1}{8}$
2.	$\frac{2}{9}$	$\frac{1}{3}$	$\frac{4}{9}$	$\frac{5}{9}$	$\frac{2}{3}$	$\frac{8}{9}$	$\frac{7}{9}$	$1\frac{1}{3}$	$2\frac{2}{9}$	$\frac{1}{9}$
3.	$\frac{3}{10}$	$\frac{7}{10}$	$\frac{1}{5}$	$\frac{9}{10}$	$\frac{2}{5}$	$\frac{1}{2}$	$\frac{4}{5}$	$2\frac{1}{10}$	$2\frac{2}{5}$	$\frac{1}{10}$
4.	$\frac{3}{4}$	$\frac{5}{6}$	$\frac{2}{3}$	$\frac{7}{8}$	$\frac{4}{5}$	$\frac{6}{7}$	$\frac{8}{9}$	$1\frac{1}{2}$	$2\frac{3}{4}$	$\frac{2}{3}$
5.	$\frac{9}{10}$	$\frac{7}{8}$	$\frac{5}{8}$	$\frac{15}{16}$	$\frac{13}{16}$	$\frac{11}{16}$	$\frac{9}{16}$	$1\frac{3}{8}$	$2\frac{3}{4}$	$\frac{3}{8}$
6.	$4\frac{1}{2}$	$2\frac{2}{3}$	5	6	$3\frac{1}{5}$	$3\frac{3}{8}$	3	9	$3\frac{3}{4}$	$2\frac{2}{3}$
7.	$5\frac{1}{2}$	$3\frac{1}{4}$	$4\frac{3}{4}$	$2\frac{1}{8}$	$3\frac{1}{2}$	$4\frac{3}{8}$	$2\frac{5}{8}$	$4\frac{7}{8}$	$7\frac{1}{8}$	$1\frac{3}{4}$
8.	$1\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{2}{3}$	$3\frac{2}{3}$	$5\frac{3}{4}$	$6\frac{7}{8}$	$7\frac{9}{10}$	$8\frac{5}{6}$	$7\frac{4}{5}$	$1\frac{1}{2}$
9.	$1\frac{1}{2}$	$2\frac{1}{4}$	$3\frac{1}{5}$	$2\frac{1}{6}$	$7\frac{1}{10}$	$4\frac{1}{3}$	$1\frac{1}{8}$	$5\frac{1}{7}$	$6\frac{1}{9}$	$\frac{1}{2}$
10.	$2\frac{4}{5}$	$3\frac{1}{2}$	$2\frac{5}{6}$	$4\frac{4}{5}$	$3\frac{2}{3}$	$3\frac{1}{4}$	$4\frac{1}{6}$	$4\frac{1}{5}$	$3\frac{3}{4}$	$2\frac{4}{5}$

WAYS OF COMPARING NUMBERS BY RATIOS

There are various ways of comparing numbers.

1. How much more than 10 is 12?

2. How much less than \$15 is \$8?

In both these problems the numbers were compared by subtraction. Numbers may also be compared by division.

3. An apple costs 2¢ and an orange costs 6¢. How many times as much as an apple does an orange cost?

Think: $6 \div 2 = 3$. An orange costs 3 times as much as an apple.

4. If a banana costs 4¢ and a pear costs 8¢, what fraction of the cost of a pear is the cost of a banana?

Think: 4 is what fraction of 8? You can see that 4 is $\frac{1}{2}$ of 8.

This is found by dividing 4 by 8. $\frac{4}{8} = \frac{1}{2}$.

When numbers are compared by division, we find their *ratio*. *To find the ratio of two numbers, divide one by the other.*

5. What is the ratio of 10 to 5?

Think: $10 \div 5 = ?$

6. What is the ratio of 2 to 8?

7. A train can travel 40 miles an hour and a man can walk about 4 miles an hour. Compare the speed of the train with that of the man.

Think: What is the ratio of 40 to 4?

What is the ratio of:

8.	4 to 8?	**12.**	9 to 18?	**16.**	15 to 25?	**20.**	$\frac{1}{2}$ to $\frac{1}{4}$?
9.	6 to 3?	**13.**	18 to 9?	**17.**	18 to 24?	**21.**	$\frac{1}{8}$ to $\frac{5}{8}$?
10.	12 to 4?	**14.**	14 to 6?	**18.**	16 to 12?	**22.**	$1\frac{1}{2}$ to $\frac{3}{4}$?
11.	2 to 5?	**15.**	1 to 3?	**19.**	2 to 3?	**23.**	$3\frac{1}{3}$ to 10?

24. How many times as much as a $2\frac{1}{2}$-pound chicken does a 5-pound chicken weigh? $5 \div 2\frac{1}{2} = ?$

REVIEW OF MEASUREMENTS

A. Test in Values of Units of Measure

Write the number that should be in each blank below.

1. 1 ft. = ——— in.
2. 1 qt. = ——— pt.
3. 1 bu. = ——— pk.
4. 1 lb. = ——— oz.
5. 1 hr. = ——— min.
6. $1 = ——— dimes.
7. 1 cwt. = ——— lb.
8. 1 mi. = ——— yd.
9. 1 bu. = ——— qt.
10. 1 A. = ——— sq. rd.
11. 1 mi. = ——— ft.
12. 1 rd. = ——— yd.
13. 24″ = ———′.
14. 1 wk. = ——— da.
15. 1 pk. = ——— qt.
16. $3\frac{1}{2}'$ = ———″.
17. 1 T. = ——— lb.
18. 1 mi. = ——— rd.
19. 1 dime = ——— cents.
20. 1 gal. = ——— qt.
21. 1 yd. = ——— ft.
22. 1 yr. = ——— mo.
23. 1 sq. ft. = ——— sq. in.
24. 1 cu. ft. = ——— cu. in.
25. 1 sq. yd. = ——— sq. ft.
26. 1 min. = ——— sec.
27. 1 doz. = ——— things.
28. 1 quarter = ——— nickels.
29. 1 ordinary yr. = ——— da.
30. 1 leap yr. = ——— da.
31. 1 rd. = ——— ft.
32. 1 cu. yd. = ——— cu. ft.

B. Test in Changing the Form of Units of Measure

1. 18 in. = — ft. — in.
2. 5 ft. = — yd. — ft.
3. 27 oz. = — lb. — oz.
4. 45 min. = — hr.
5. 18 in. = — yd.
6. 18 qt. = — gal. — qt.
7. 2,500 lb. = — T. — lb.
8. 10 pk. = — bu. — pk.
9. 7 pk. = — bu.
10. 27 sq. ft. = — sq. yd.
11. 1,728 cu. in. = — cu. ft.
12. 880 yd. = — mi.

C. Writing Tables of Measure

1. Write the table of square measure; of cubic measure.
2. Write the table of dry measure.
3. Write the table of liquid measure.

USING FRACTIONS IN BUYING AND SELLING

Fractions are used very often in buying and selling. If you are rapid and accurate with fractions, you will check very easily the amounts you pay for things that you buy.

1. Harry was a clerk in a grocery store. Mrs. Andrews asked for 25¢ worth of cheese. If cheese was 48¢ a pound, how much should he give her?

$\frac{25}{48} \times 16 = ?$ $\frac{25}{\cancel{48}_{3}} \text{ of } \cancel{16} = \frac{25}{3} = 8\frac{1}{3}$	Harry thought, "If cheese is 48¢ a pound, 25¢ worth would be $\frac{25}{48}$ of a pound. I shall give her $8\frac{1}{3}$ ounces of cheese."

2. Another customer asked Harry for 30¢ worth of cheese. How many ounces did he give her?

3. Mary wanted 5¢ worth of apples. If apples were 20¢ a dozen, how many did she buy?

4. If oranges are 40¢ a dozen, how many can you buy for 10¢? for 20¢? for 30¢? for 50¢?

5. If bacon is 50¢ a pound, how much can you buy for 75¢?

6. Cookies are 25¢ a dozen. How many can you buy for 10¢? for 15¢?

7. How many inches of ribbon can you buy for 15¢ if the price is 45¢ a yard?

8. At 50¢ a pound, you can buy ——— ounces for 25¢.

9. At 40¢ a pound, you can buy ——— ounces for 15¢.

10. At 36¢ a pound, you can buy ——— ounces for 27¢.

11. At 30¢ a dozen, you can buy ——— apples for 10¢.

12. At 45¢ a dozen, you can buy ——— oranges for 30¢.

COMPARING SPEEDS

This table shows different methods of travel and the speed for each method in miles an hour.

A man on foot	3 mi.	An ocean liner	30 mi.
A horse	9 mi.	A freight train	15 mi.
An automobile	30 mi.	A racing automobile	207 mi.
A fast passenger train	60 mi.	An airplane	278 mi.

Find the number that should be written in the blank space in each of the following problems:

1. The speed of a horse is —— times that of a man.

2. The speed of a passenger train is —— times that of a horse.

3. A passenger train travels —— times as fast as a freight train.

4. An airplane travels —— times as fast as a passenger train.

5. An ocean liner travels —— times as fast as an automobile.

6. The speed of an ocean liner is —— miles an hour more than a freight train.

7. An airplane travels —— miles an hour faster than a fast passenger train.

8. An ocean liner travels —— miles less in an hour than a racing automobile.

9. An automobile can travel —— times as far as a horse in an hour.

10. 8 is —— times 4.

11. 6 is —— times 4.

12. 5 is —— times 4.

13. 7 is —— times $1\frac{3}{4}$.

14. 3 is —— times 6.

15. 8 is —— times 24.

16. $\frac{1}{2}$ is —— times $\frac{3}{4}$.

17. $2\frac{1}{4}$ is —— times $\frac{4}{9}$.

18. $3\frac{1}{3}$ is —— times 10.

19. 100 is —— times 1,000.

20. What is the ratio of $7\frac{1}{2}$ and $2\frac{1}{2}$?

PRACTICE IN COMPARING NUMBERS

In which of these pairs of numbers is the first number equal to one third of the second?

1. 2, 6	**8.** 4, 2	**15.** 4, 1	**22.** 6, 18
2. 12, 3	**9.** 20, 5	**16.** 8, 4	**23.** 1, 3
3. 8, 40	**10.** 4, 12	**17.** 2, 10	**24.** 16, 4
4. 14, 7	**11.** 32, 8	**18.** 16, 8	**25.** 8, 24
5. 7, 21	**12.** 18, 9	**19.** 2, $\frac{1}{2}$	**26.** 1, 5
6. $\frac{1}{2}$, $\frac{1}{8}$	**13.** $\frac{1}{2}$, $2\frac{1}{2}$	**20.** 9, 27	**27.** $2\frac{1}{2}$, $7\frac{1}{2}$
7. $\frac{1}{2}$, $1\frac{1}{2}$	**14.** $1\frac{1}{2}$, $\frac{3}{4}$	**21.** $3\frac{1}{3}$, 10	**28.** $1\frac{1}{3}$, $\frac{1}{3}$

In which of the above pairs of numbers is the first number equal to 2 times the second?

In which is the first number equal to 4 times the second?

REDUCTIONS AT SALES

1. Helen bought a \$5 tennis racket for \$3.75. What was the reduction? What fraction of the regular price was the reduction?

\$5.00 − \$3.75 = \$1.25. The reduction is \$1.25.

To find what fraction \$1.25 is of \$5.00, divide 125 by 500:

$\frac{125}{500} = \frac{1}{4}$ \$1.25 is $\frac{1}{4}$ of \$5.00.

Copy the following examples, and find the correct figures to replace each question mark.

	Regular Price	Sale Price	Reduction	Fraction of Regular Price
Baseball bat	\$2.00	\$1.50	?	?
Gymnasium slippers	3.00	2.50	?	?
Bicycle tires	4.50	3.50	?	?
Football	5.00	4.50	?	?
Slide	30.00	24.00	?	?
Swing	3.75	2.50	?	?

THE SCHOOL MILK SUPPLY

In the Randall Ward School milk was furnished to the children in the various grades. The pupils ordered the milk for a week in advance. The same quantity was delivered each day. The sixth-grade pupils kept the records.

Grade	Number of Pupils	Milk Ordered Daily
Kindergarten	63	45 half-pint bottles
First grade	32	24 " " "
Second grade	38	19 " " "
Third grade	36	16 " " "
Fourth grade	33	18 " " "
Fifth grade	35	10 " " "
Sixth grade	30	9 " " "

1. How many bottles of milk were ordered daily?

2. How many bottles a week were ordered?

3. At 3¢ for a half-pint bottle, how much did the children in each grade pay a day for the milk?

4. How much was spent in all for the milk each day for the whole school?

5. How many bottles of milk less than there were pupils in the school were ordered daily?

6. The milkman received $2\frac{1}{2}$¢ a bottle for the milk. How much did he receive a day for the milk? how much a week?

7. The sixth-grade class made $\frac{1}{2}$ cent on each bottle sold. What was the profit on the milk sold in a week?

8. The following supplies were purchased: 4 boxes of straws at $22\frac{1}{2}$¢ a box, 10 pounds of soda wafers at $12\frac{1}{2}$¢ a pound. What did these supplies cost?

9. If the same quantity of milk is ordered each week, how long will it take the class to pay for the supplies out of the profits from the sale of the milk?

*10. The city nurse believes that 3 of the children need the milk, but cannot afford it. What will a week's supply for these children cost?

*11. The secretary of the Woman's Club asked the following questions regarding the supplying of milk in the Randall School:

a. What fraction of the pupils in each grade are ordering milk?

b. How many gallons are being supplied weekly?

c. How many more gallons would be required if milk were purchased for all the pupils?

d. What would be the additional cost?

e. What would be the total cost of supplying all the pupils with milk for the school year of 38 weeks?

*12. If each pupil in your school were to have a half pint of milk a day, how many bottles would be needed?

*13. How many gallons of milk would be needed?

*14. What would the milk cost at local prices?

*15. Why is it important for children to drink milk each day?

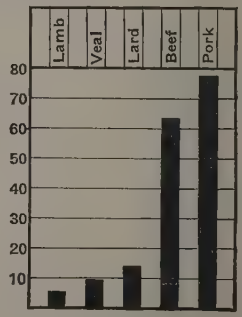
A MIXED DRILL

Give the answers orally. Do not use a pencil. Practice until the work is easy.

1. $27 + 48 =$	**16.** $\frac{4}{5} \div \frac{2}{3} =$	**31.** $3\frac{1}{3} + 4\frac{5}{6} =$
2. $93 - 67 =$	**17.** $\$.06 + \$.03 =$	**32.** $3\frac{4}{5} - \frac{9}{10} =$
3. $9 \times 86 =$	**18.** $47 + 36 =$	**33.** $3\frac{3}{4} \times \frac{1}{5} =$
4. $256 \div 32 =$	**19.** $95 - 38 =$	**34.** $\$5 \div 10 =$
5. $\frac{1}{3} + \frac{1}{6} =$	**20.** $7 \times 58 =$	**35.** $37 + 59 =$
6. $5 - \frac{1}{4} =$	**21.** $540 \div 60 =$	**36.** $86 - 49 =$
7. $\frac{9}{10} \times \frac{5}{6} =$	**22.** $2\frac{1}{2} + \frac{1}{6} =$	**37.** $7 \times 96 =$
8. $5 \div \frac{1}{4} =$	**23.** $2\frac{1}{4} - \frac{1}{5} =$	**38.** $312 \div 78 =$
9. $65 + 29 =$	**24.** $2\frac{1}{3} \times 3 =$	**39.** $7\frac{1}{2} + \frac{1}{4} + \frac{3}{8} =$
10. $74 - 29 =$	**25.** $3\frac{1}{2} \div 7 =$	**40.** $4\frac{5}{8} - 3\frac{11}{16} =$
11. $8 \times 79 =$	**26.** $\$.06 \times 8 =$	**41.** $20 \times 3\frac{1}{8} =$
12. $343 \div 49 =$	**27.** $25 + 68 =$	**42.** $\$.35 - \$.07 =$
13. $\frac{3}{4} + \frac{3}{4} =$	**28.** $52 - 37 =$	**43.** $3\frac{1}{5} \div \frac{4}{5} =$
14. $9 - \frac{2}{3} =$	**29.** $9 \times 79 =$	**44.** $8 \times 85 =$
15. $8 \times \frac{4}{4} =$	**30.** $486 \div 54 =$	**45.** $79 + 14 =$

OUR ANNUAL MEAT CONSUMPTION

The graph at the right shows the amounts of the different kinds of meat and lard consumed a year, on the average, by each person in the United States.



1. Find the amount of pork consumed a person a year.

You cannot tell exactly the number of pounds but you can see that about 78 pounds of pork were consumed.

2. Estimate the number of pounds of beef consumed a year in the same way that you estimated the number of pounds of pork.

3. Estimate the amount of veal consumed a year by each person; the amount of lamb; the amount of lard.

4. Find the total amount of meat consumed a year on the average.

5. Estimate the number of pounds of meat and lard consumed a person a year.

6. If a family of five adults ate the average amount of each kind of meat, how many pounds of each kind did this family eat in a year?

7. Find the total amount of meat eaten by this family in a year.

8. How many pounds less of beef than of pork were eaten, on the average, by each person?

9. How many pounds of beef and veal were used?

10. How many pounds of pork and lard were used?

11. The beef used is how many times the amount of veal used?

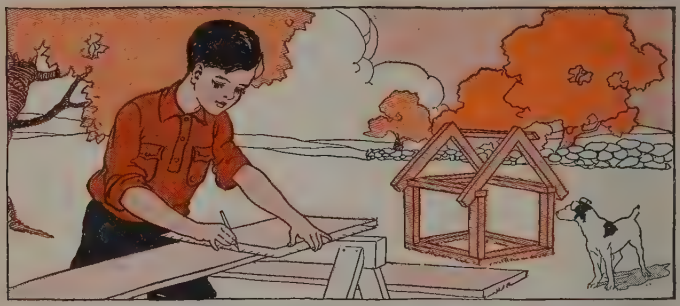
12. The amount of beef used is how many times the weight of the mutton used?

13. What is the ratio of the number of pounds of lamb used to the number of pounds of veal?

14. How many times as much pork as veal is used?

15. Choice porterhouse steak sells in some of our cities at 65¢ a pound. Chuck roasts may be bought for about 28¢ a pound. What would be the cost of the beef used annually by a man who used only porterhouse? How much less would he spend if he used only chuck roasts?

16. Englishmen eat only $\frac{5}{8}$ as much meat as we do. How many pounds of meat are consumed, on the average, each year by an Englishman?



BUILDING A DOG HOUSE

1. Donald is building a dog house for his fox terrier, Spot. For the back of the house he needs three boards each $2\frac{1}{3}$ feet long. He has three pieces of board of the correct width, one $2\frac{2}{3}$ feet long, another $2\frac{1}{2}$ feet long, and another $2\frac{3}{4}$ feet long. How much of each board will be left after he cuts off the length that he needs?

2. What is the total length of the 3 boards used for the back of the dog house?

3. Donald needs, also, 9 boards, each $2\frac{1}{4}$ feet long, for the floor and sides. How many of these can he cut from a 9-foot board?

4. After getting all the lengths he can from the 5-foot board, Donald plans to cut the rest of these $2\frac{1}{4}$-foot pieces from an 15-foot board.

a. Can he get the rest of these pieces from this board?

b. If so, how much of the board will be left after he has cut off these pieces?

5. For the roof of the dog house, Donald needs 6 boards each $1\frac{1}{2}$ feet long. If he cuts the roof pieces from a 9-foot board, how much of the board will he have left?

PRACTICE TESTS IN FUNDAMENTALS

Addition Test (4 examples in 5 minutes, including checking but not copying)

1.	2.	3.	4.	5.	6.
927	747	788	869	123	113
855	902	484	926	861	795
562	627	868	742	289	571
689	956	433	488	575	574
375	847	973	647	241	313
869	945	809	583	395	644
348	698	587	376	319	625

Subtraction Test (5 examples in 2 minutes, including checking but not copying)

1.	2.	3.	4.	5.	6.
94,170	81,004	90,135	74,628	96,115	87,928
27,365	26,378	26,497	55,879	37,569	87,856

Multiplication Test (6 examples in 3 minutes, including checking but not copying)

1.	3.	5.	7.	9.	11.
428	529	719	246	913	356
57	63	94	28	75	49
2.	**4.**	**6.**	**8.**	**10.**	**12.**
163	657	817	824	935	847
63	75	82	49	28	36

Division Test (6 examples in 8 minutes, including checking but not copying).

1. $36\overline{)47,621}$	3. $73\overline{)28,436}$	5. $64\overline{)20,544}$	7. $81\overline{)56,943}$
2. $35\overline{)10,998}$	4. $58\overline{)10,672}$	6. $38\overline{)14,668}$	8. $44\overline{)13,508}$

PRACTICE TESTS IN FRACTIONS

Addition (10 minutes)

1. $\frac{4}{5} + \frac{2}{5}$
2. $4 + 1\frac{2}{3}$
3. $2\frac{1}{3} + 7\frac{2}{3}$
4. $\frac{1}{4} + \frac{1}{2} + \frac{1}{4}$
5. $5\frac{5}{6} + 2\frac{5}{6}$
6. $1\frac{1}{8} + \frac{1}{8} + 2\frac{7}{8}$
7. $7\frac{3}{4} + 3\frac{1}{2}$
8. $\frac{3}{4} + \frac{1}{6} + \frac{1}{8}$
9. $1\frac{1}{6} + 7\frac{3}{5}$
10. $6\frac{2}{3} + 4\frac{3}{4}$
11. $\frac{2}{5} + 1\frac{2}{3}$
12. $\frac{2}{3} + \frac{1}{4} + 4\frac{1}{12}$

Subtraction (10 minutes)

1. $4\frac{4}{5} - \frac{1}{5}$
2. $6\frac{2}{3} - 1\frac{2}{3}$
3. $3\frac{1}{2} - \frac{1}{2}$
4. $4\frac{4}{5} - 1\frac{2}{5}$
5. $7\frac{5}{8} - 6\frac{1}{8}$
6. $3 - 1\frac{2}{3}$
7. $10\frac{1}{3} - 3\frac{2}{3}$
8. $9\frac{1}{6} - 1\frac{5}{6}$
9. $3\frac{3}{4} - 2\frac{1}{2}$
10. $7\frac{3}{4} - 1\frac{1}{10}$
11. $8\frac{1}{8} - 1\frac{1}{3}$
12. $7\frac{1}{5} - 6\frac{3}{4}$

Multiplication (10 minutes)

1. $\frac{1}{8}$ of $3 =$
2. $5 \times \frac{1}{10} =$
3. $12 \times \frac{1}{5} =$
4. $\frac{1}{2} \times \frac{7}{10} =$
5. $\frac{5}{9} \times \frac{3}{10} =$
6. $\frac{5}{8} \times \frac{16}{25} \times \frac{1}{2} =$
7. $2 \times 4\frac{1}{3} =$
8. $3\frac{1}{5} \times 2 =$
9. $\frac{1}{2}$ of $1\frac{1}{7} =$
10. $\frac{5}{8} \times 3\frac{1}{5} =$
11. $6\frac{4}{5} \times \frac{3}{7} =$
12. $18\frac{1}{4} \times 15 =$

Division (10 minutes)

1. $2 \div \frac{4}{5} =$
2. $\frac{5}{6} \div \frac{3}{10} =$
3. $1\frac{1}{2} \div \frac{1}{2} =$
4. $\frac{5}{6} \div 4 =$
5. $1\frac{1}{4} \div 4 =$
6. $5\frac{2}{5} \div 1\frac{4}{5} =$
7. $4\frac{3}{5} \div 6 =$
8. $\frac{3}{8} \div \frac{3}{8} =$
9. $3 \div 4\frac{1}{2} =$
10. $5 \div 2\frac{1}{2} =$
11. $1\frac{1}{5} \div 3\frac{1}{2} =$
12. $7\frac{3}{5} \div 7\frac{3}{5} =$

Practice the examples in each test until you can work all of them correctly in less than the time allowed.

DIAGNOSTIC TEST NO. I

This exercise will test your ability to work different kinds of examples. If you have difficulty with any of the examples, practice on others like them.

1. $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} =$
2. $25\frac{3}{4} - 16\frac{7}{8} =$
3. $7\frac{3}{4} \times 28 =$
4. $3\frac{1}{3} \div \frac{2}{3} =$
5. Divide 290,639 by 571.
6. Find the product of 408 and 709.
7. Find $\frac{3}{4}$ of 42.
8. Change 3 yards 6 inches to inches.
9. Find the number of gallons in 48 pints.
10. $60 = ? \times 4$.
11. Find the average of 47, 36, and 91.
12. $100 \times 48 =$; $10 \times 46 =$
13. What is the ratio of 50 to 100?
14. Compare $\frac{7}{8}$ and $\frac{3}{4}$ by division.
15. 16 is what fraction of 32?
16. 48 is what part of 60?
17. Find the sum of 684, 336, 956, 742, 493, and 536.
18. Subtract 25,896 from 98,921.
19. Multiply 747 by $23\frac{7}{9}$.
20. Divide 481,216 by 5,856.

PROBLEM SCALE I

1. One morning Harry dug $8\frac{1}{2}$ bushels of potatoes. He sold $4\frac{1}{4}$ bushels to a neighbor. In the afternoon he dug $3\frac{1}{4}$ bushels more. How many bushels did he then have?

2. A man living in a village kept two cows. One gave

$6\frac{1}{2}$ pounds of butterfat a week; the other gave $1\frac{1}{2}$ pounds more. How many pounds did they both produce in a week?

3. A lady bought $4\frac{1}{3}$ yards of calico at 15¢ a yard for a dress and other material costing \$.75. Find the total cost.

4. Harry raised $25\frac{1}{4}$ bushels of potatoes on a part of his father's garden. He gave his father $6\frac{1}{2}$ bushels for the rent of the land and sold the rest for \$1.00 a bushel. How much did he receive for them?

5. Harry worked at the drug store $1\frac{3}{4}$ hours on Wednesday and $2\frac{1}{2}$ hours on Saturday. He was paid \$.40 an hour. How much did he earn for his work on the two days?

6. Mary wished to make 4 pennants. If she needed $\frac{3}{8}$ yard of ribbon for each pennant, what would the ribbon cost at \$.20 a yard?

7. Mr. Jones had 100 pounds of chicken feed in a bag. He filled a 10-pound can and a small pail with the feed. He then found that he had $75\frac{1}{2}$ pounds of chicken feed left in the bag. What did the feed in the pail weigh?

8. Some boy scouts planned to take a $6\frac{1}{4}$-mile hike before school one morning. If they left at 6 o'clock and walked at the rate of $2\frac{1}{2}$ miles an hour, at what time would they return?

9. Five men went on a camping trip. They estimated that they should have $1\frac{1}{2}$ pounds of flour a day for each man. If they took 150 pounds of flour with them, how long would it last at this rate?

10. Mr. Smith used $7\frac{1}{2}$ bushels of seed corn to plant a 10-acre field. Find the cost of seed corn an acre at \$2.20 a bushel.

Standards	
Excellent	9 or 10 correct
Good	7 or 8 correct
Fair	5 or 6 correct
Unsatisfactory	0 to 4 correct

CHAPTER II

A RAILROAD TIME-TABLE

Below is a section of a railroad time-table.

TABLE 8 CLINTON—ANAMOSA

143	141	Mi.	STATIONS	142	144
AM	PM			PM	PM
8.00	4.35	0.	Lv ..... CLINTON ..... Ar	12.05	2.30
8.20	4.45	2.6	Ar ..... Lyons Lv	11.54	2.15
8.45	5.02	10.4	" ..... Almont ..... "	11.37	2.00
8.55	5.09	12.8	" ..... Andover ..... "	11.30	1.50
9.15	5.20	17.2	" ..... Bryant ..... "	11.20	1.40
9.30	5.27	19.8	" ..... Goose Lake ..... "	11.10	1.20
9.50	5.38	24.6	" ..... Charlotte ..... "	10.59	1.05
10.10	5.47	28.7	" ..... Petersville ..... "	10.49	12.40
10.40	5.57	32.7	" ..... Delmar ..... "	10.40	12.25
11.10	6.10	38.1	" ..... Maquoketa ..... "	10.25	12.05
11.30	6.25	44.3	" ..... Nashville ..... "	10.09	11.30
11.40	6.30	47.0	" ..... Baldwin ..... "	10.02	11.20
11.55	6.40	49.6	" ..... Monmouth ..... "	9.55	11.10
12.20	6.59	56.8	" ..... Onslow ..... "	9.37	10.45
12.35	7.09	60.8	" ..... Center Junction ..... "	9.27	10.20
12.50	7.20	65.8	" ..... Amber ..... "	9.15	10.05
1.15	7.35	71.4	Ar ..... ANAMOSA Lv	9.00	9.45

1. At what time does Train No. 141 leave Clinton?

2. How far is it from Clinton to Anamosa?

3. How long does it take to travel from Clinton to Anamosa?

4. Copy the following table and fill in the missing information:

	DISTANCE	TIME
Clinton to Goose Lake.....		
Goose Lake to Amber.....		
Andover to Center Junction.....		
Lyons to Monmouth.....		
Nashville to Anamosa.....		

ADDITION AND SUBTRACTION OF DECIMALS

1. The newspaper reported that on Monday 1.7 inches of rain fell, on Tuesday 2.25 inches, and on Wednesday 1.875 inches. How much rain fell during the three days?

1.7 2.25 1.875 5.825	1.7 in. + 2.25 in. + 1.875 in. = ? Write these numbers so that the decimal points are in a straight line one under the other. Add as with whole numbers. Place the decimal point in the sum under the decimal points in the numbers being added.

2. How many inches of rain fell on Monday and Tuesday? on Tuesday and Wednesday?

3. How much more rain than on Monday fell on Wednesday?

1.875 in. −1.7 in. .175 in.	1.875 in. − 1.7 in. = ? Write the numbers so that the decimal points are in a line one under the other. Place the decimal point in the answer directly under the decimal points in the numbers subtracted.

4. How much less rain than on Tuesday fell on Wednesday?

2.250 in. 1.875 in. .375 in.	2.25 in. − 1.875 in. Write a 0 in the minuend so that the minuend will have the same number of decimal places as the subtrahend.

Find the sum of each of the following examples:

5.	**6.**	**7.**	**8.**
3.257	5.92	85.4	85.
4.267	68.75	7.63	7.275
8.15	74.156	194.85	1.04

Subtract the following:

9. 9.46 ft.	**10.** 8.714 mi.	**11.** 17.48 lb.	**12.** 147.5
7.14 ft.	5.26 mi.	9.564 lb.	5.267

13. An airplane flew 95.7 miles one day, 76.24 miles the second day, and 796.89 miles the third day. How many miles did the airplane fly in three days?

14. The total weight of a wagon loaded with coal was 4.8 tons. The wagon alone weighed .375 ton. Find the weight of the coal.

15. At a field meet a runner ran 100 yards in 9.65 seconds. The record for the track was 10.1 seconds. How much less time than the record did the runner take?

Copy the numbers in each example and find the sums. Be sure to place the decimal points one under the other.

16. .85, .81, .46, 74
17. .3, .75, .46, .014, .5
18. .58, .475, .6, .84, .7
19. 3.8, 1.75, 5.9, 6.741
20. 97.5, 884.6, 9.75, .5
21. 64.66, 78.9, 5.974, 6.4
22. 347.1, 58.6, 7.94, 1.8
23. 5.6, .6, 7.85, 100.4

Subtract the following:

24. 6.48 − 4.51 =
25. 5.9 − 4.72 =
26. 12.175 − 2.11 =
27. 18.547 − 7.368 =
28. 5.7 − 1.743 =
29. 200.3 − 5.64 =
30. 8 − 5.62 =
31. 77.8 − .85 =
32. 49.7 − 48.75 =
33. 33.50 − .675 =

34. Helen rode 22.5 miles on her new bicycle on Monday, 17.1 miles on Tuesday, and only .9 mile on Wednesday. How many miles did she ride on these three days?

35. Jack's father drove 231.6 miles in his automobile on Monday and 75.9 miles on Tuesday. How much farther than on Tuesday did he drive on Monday?

TWO WAYS OF READING DECIMALS

1. Read this mixed decimal: 43.764. This number may be read *43 and 764 thousandths*. Business people have found that an easier and more accurate way of reading such a number is as follows: *Four three point seven six four*. The word *point* shows where the decimal point is.

Read these decimals in two ways. Which do you think is the easier way? Then write them from dictation. Your teacher will dictate them in the two ways. Was one way easier and more accurate than the other?

	a	*b*	*c*	*d*	*e*
2.	9.75	3.005	63.15	.003	100.1
3.	86.2	68.02	9.875	1.043	101.1
4.	95.047	75.109	160.01	120.006	1.001

USING THE DECIMAL POINT

In the following sentences there are numbers with the decimal points missing. Place the decimal point so that the statements are reasonable.

1. A boy was 575 inches tall.

2. He weighed 9725 pounds.

3. He gained 75 pounds in weight in one year.

4. A train traveled 365 miles an hour.

5. The world's record for the hundred-yard dash is 94 seconds.

6. The cost of a school reader is $125.

7. 45 inches of rain fell in one day.

8. Mrs. Jones bought a roast weighing 375 pounds.

9. An ocean liner has a record of 325 miles an hour.

10. A dozen eggs weigh 175 pounds.

11. A quart of milk weighs about 213 pounds.

12. Three inches is 25 yard.

LONGER DECIMALS

Sometimes numbers are used in which there are more than three decimal places. For example, some of the parts for automobiles are accurate to one ten thousandth of an inch (.0001 in.). A difference of .00015 inch is read 15 hundred-thousandths of an inch. .17684 is read 17 thousand 684 hundred-thousandths.

Hundred Thousands	Ten thousands	Thousands	Hundreds	Tens	Units	Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths	Millionths
6	0	8,	7	4	1.	5	9	6	2	3	2

Read the name of each digit of the number above, 608,741.596232. How do the names of the digits to the right of the units differ from those to the left?

In most of the work which you will do with decimals, you will not use more than three decimal places; but so that you may know how to read decimal numbers of 4 or 5 places, practice reading the following numbers:

1. .1572	**3.** .13684	**5.** 3.5764	**7.** 5.17004
2. .0465	**4.** .57963	**6.** 4.0001	**8.** 27.00475

Write as numbers:

9. One hundred twenty ten-thousandths.

10. Six thousand eight hundred-thousandths.

11. Three and nine ten-thousandths.

12. Fifty-six and eighty-five ten-thousandths.

MULTIPLYING DECIMALS BY 10, 100, 1,000

1. At \$.05 each, what is the cost of 10 apples? 100 apples? 1,000 apples?

$10 \times \$.05 = \$.50$ $100 \times .05 = 5.00$ $1{,}000 \times .05 = 50.00$	Notice how the decimal point is shifted when \$.05 is multiplied by 10, 100, 1,000.

To multiply a decimal by 10, shift the decimal point one place to the right; to multiply by 100, shift the decimal point two places to the right; and to multiply by 1,000, shift the decimal point three places to the right.

Give the products:

2. $10 \times .15 =$ **6.** $100 \times .15 =$ **10.** $1{,}000 \times .15 =$
3. $10 \times .04 =$ **7.** $100 \times .04 =$ **11.** $1{,}000 \times .04 =$
4. $10 \times 1.5 =$ **8.** $100 \times 1.5 =$ **12.** $1{,}000 \times 1.5 =$
5. $10 \times 1.06 =$ **9.** $100 \times 1.06 =$ **13.** $1{,}000 \times 1.06 =$

MULTIPLYING A DECIMAL AND A WHOLE NUMBER

A certain automobile made a mile in 26.45 seconds. How long would it take the automobile to go 5 miles?

26.45 5 132.25	When multiplying a decimal by a whole number, multiply as with whole numbers. Point off as many places in the product as there are decimal places in the numbers being multiplied.

Find these products:

1. $3 \times 2.75 =$ **3.** $4 \times .035 =$ **5.** $24 \times 37.5 =$
2. $12 \times 36.25 =$ **4.** $83 \times 2.684 =$ **6.** $93 \times 8.002 =$

7. How far can an ocean liner go in 6 hours at the rate of 22.65 knots an hour?

MULTIPLYING A DECIMAL BY A DECIMAL

1. What is the product of .3 and .3?

Change .3 to $\frac{3}{10}$. $\frac{3}{10} \times \frac{3}{10} = \frac{9}{100} = .09$

$.3 \times .3 = .09$

2. What is the product of .3 and .07?

Change .3 to $\frac{3}{10}$ and .07 to $\frac{7}{100}$

$.3 \times .07 = \frac{3}{10} \times \frac{7}{100} = \frac{21}{1000} = .021$

3. For each of these two examples answer the following questions:

a. How many decimal places are in the multiplier?

b. How many decimal places are in the multiplicand?

c. How many decimal places are in the product?

d. How does the number of decimal places in the product compare with the number in the multiplier and in the multiplicand together?

The following rule will help you when you are multiplying two numbers containing decimals:

After multiplying one decimal by another, point off as many decimal places in the product as there are decimal places in the numbers being multiplied. Count from the right.

Apply this rule to the examples below:

a	*b*	*c*	*d*
4.7 ft.	$4.18	.165	275
.5	3	.3	1.7
2.35 ft.	$12.54	.0495	1925
			275
			467.5

PRACTICE IN PLACING DECIMAL POINTS IN MULTIPLICATION

The following examples are finished, except for the placing of the decimal points in the products. Copy each example and insert the decimal point in the product.

1. 4.1 × .3 = 123	**5.** 5.2 × 4 = 208	**9.** .26 × 4 = 104	**13.** .47 × .5 = 235
2. 25 × .7 = 175	**6.** 2.64 × .3 = 792	**10.** 58.4 × .05 = 2920	**14.** 26.04 × .9 = 23436
3. 25.7 × .12 = 3084	**7.** .25 × .3 = 75	**11.** .573 × .4 = 2292	**15.** 6.25 × .94 = 58750
4. 8.74 × .08 = 6992	**8.** 6.57 × 1.5 = 9855	**12.** 25.6 × .74 = 18944	**16.** .21 × .4 = 84

MULTIPLYING WITH DECIMALS

1. At the rate of 32.5 miles an hour, how far will a passenger train travel in 7.5 hours?

Find the products.

2. .01 × 0.2	**5.** .64 × 0.1	**8.** .874 × 2	**11.** .985 × 3	**14.** 6.47 × 3
3. 715 × .008	**6.** 847 × .032	**9.** 5.73 × 6.1	**12.** 85.2 × .97	**15.** 384 × 0.08
4. 37.5 × .42	**7.** 5.01 × .16	**10.** 3.04 × 1.5	**13.** 52.1 × .04	**16.** 35.6 × .07

17. Find the cost of 3.4 gallons of gasoline at 25¢ a gallon.

FINDING RAILROAD FARES

Railroad officials use decimals in determining the fare between stations. If the rate is 3.6¢ a mile, and the distance between two stations, such as Omaha and Sioux City, is 98.5 miles, they say the fare is 99 × 3.6¢, or $3.56.

$.036 \times 99 = ?$	3.6¢ can be written as $.036.
.036	How many decimal places are in the multiplier and the multiplicand?
99	How many decimal places must there be in the product?
324	
3 24	The product is $3.564. Usually the decimal part of a cent is dropped if it is less than 5 tenths. The fare would, therefore, be $3.56.
3.564	

1. Find the fare from Omaha to Missouri Valley, a distance of 24.2 miles, at 3.6¢ a mile.

2. Turn to the railroad time-table from Clinton to Anamosa on page 263. Find the fare from Clinton to each of the first five stations in the table.

3. $3.5 \times 4.5¢ = ?$
4. $4.8 \times 7.5¢ = ?$
5. $84.6 \times 12.5¢ = ?$
6. $48.6 \times 25.7¢ = ?$
7. $17.25 \times 3.6¢ = ?$
8. $14.8 \times \$.375 = ?$

RAISING SUGAR CANE IN LOUISIANA

1. A good sugar-cane field will yield 17.5 tons of sugar cane an acre. How many pounds is this an acre?

2. In one year the average yield of sugar cane an acre was 10.4 tons. In another year the average yield was only 7.9 tons an acre. What was the difference between the average yields in these two years?

3. In good cane the sugar yield is $\frac{1}{10}$ the weight of the cane. How many pounds of sugar would a ton of sugar cane yield at this rate?

4. In one year a ton of cane yielded 148 pounds. How much less a ton than the yield found in problem 3 was this?

5. In a recent year the yield of cane averaged 7.9 tons an acre. At 7.2¢ a pound for raw sugar, what was the value of sugar an acre? (See problem 3.)

6. If 60 pounds of sugar cane yielded 36 pounds of juice and the juice yielded 6 pounds of sugar, what fraction of the cane was sugar? What fraction of the juice was sugar?

7. Our people eat, on the average, 148 pounds of sugar a person a year. An acre in Louisiana planted to sugar cane produced 14.8 tons of cane which yielded 140 pounds of sugar a ton. How many persons will this field supply for a year?

8. A 10-acre sugar-cane field yielded 1,598 pounds of raw sugar. What was the average yield of raw sugar an acre? What was the value of the yield an acre at 3.6 cents a pound?

PRACTICE EXERCISES IN MULTIPLICATION OF DECIMALS

Practice the examples in each set until you can work all of them correctly. Place the decimal points correctly.

Set I

	a	*b*	*c*
1.	$2 \times .2 =$	$7 \times .1 =$	$3 \times .3 =$
2.	$5 \times .01 =$	$3 \times .03 =$	$7 \times .09 =$
3.	$7 \times .001 =$	$4 \times .002 =$	$6 \times .004 =$
4.	$8 \times .5 =$	$5 \times .02 =$	$8 \times .005 =$
5.	$8 \times 4.8 =$	$6 \times 2.4 =$	$4 \times 8.5 =$
6.	$3 \times 7.59 =$	$9 \times 7.48 =$	$6 \times 8.246 =$
7.	$24 \times 8.5 =$	$.7 \times 80 =$	$.8 \times 72 =$
8.	$8 \times .6 =$	$8 \times .02 =$	$9 \times .007 =$

Set II

1.	$.4 \times .2 =$	$.3 \times .2 =$	$.6 \times .7 =$
2.	$.4 \times .01 =$	$.3 \times .03 =$	$.8 \times .07 =$
3.	$.8 \times .75 =$	$.6 \times .25 =$	$.2 \times .65 =$
4.	$.4 \times .364 =$	$.5 \times .198 =$	$.6 \times .472 =$
5.	$.2 \times 1.4 =$	$.3 \times 2.7 =$	$.4 \times 5.6 =$
6.	$2.7 \times 6.5 =$	$1.6 \times 1.7 =$	$3.2 \times 2.9 =$
7.	$.85 \times 61.9 =$	$.37 \times 82.4 =$	$2.3 \times 9.14 =$
8.	$.9 \times .9 =$	$.6 \times .08 =$	$.4 \times .75 =$

Set III

1.	$.6 \times .25 =$	$.2 \times .3 =$	$.4 \times .04 =$
2.	$.07 \times 9.23 =$	$5 \times 1.2 =$	$4.5 \times 3.4 =$
3.	$.4 \times .08 =$	$5.6 \times 1.5 =$	$.06 \times 9.08 =$
4.	$.19 \times 78.6 =$	$9.4 \times 1.6 =$	$1.8 \times 4.5 =$
5.	$8 \times 6.4 =$	$.7 \times 2 =$	$.4 \times .2 =$
6.	$7.2 \times 8.5 =$	$3.7 \times 3.6 =$	$.05 \times 3.14 =$
7.	$.5 \times .167 =$	$.4 \times 5 =$	$.15 \times .07 =$
8.	$.2 \times .75 =$	$.18 \times 17.8 =$	$.3 \times .1 =$

DIVIDING A DECIMAL BY A WHOLE NUMBER

1. Two chairs cost $17.50. Find the cost of one chair.

$$2\overline{)\$17.50}\quad \$8.75$$

If you study this example you will note that the decimal point in the quotient was placed directly over the decimal point in the dividend.

When dividing a decimal by a whole number, place the decimal point in the quotient directly over the decimal point in the dividend. Use zeros to fill empty places in the quotient.

Study these examples to see how the rule applies:

$8\overline{)9.76}\quad 1.22$	$7\overline{)45.5}\quad 6.5$	$4\overline{)1.328}\quad .332$	$5\overline{).45}\quad .09$	$2\overline{).048}\quad .024$

In the last two examples 0 was needed to fill the vacant place between the decimal point and the first figure in the quotient.

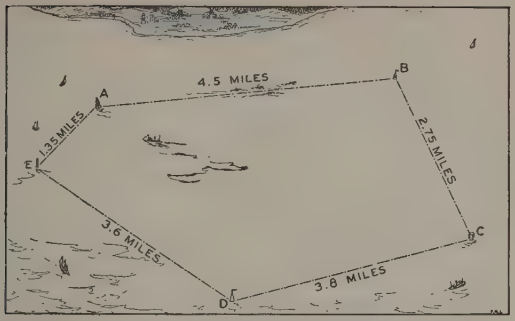
Find the quotients.

	a	*b*	*c*	*d*	*e*
2.	$5\overline{)6.75}$	$8\overline{)44.8}$	$6\overline{)5.706}$	$4\overline{).36}$	$3\overline{).096}$
3.	$7\overline{)85.4}$	$7\overline{)9.24}$	$4\overline{).48}$	$8\overline{)2.808}$	$2\overline{)15.84}$
4.	$4\overline{)3.264}$	$8\overline{).064}$	$3\overline{)7.29}$	$2\overline{).014}$	$7\overline{)4.2}$
5.	$9\overline{).45}$	$7\overline{).49}$	$6\overline{)1.578}$	$6\overline{)19.476}$	$3\overline{)8.7}$
6.	$6\overline{).126}$	$4\overline{)1.736}$	$5\overline{).0735}$	$3\overline{).75}$	$5\overline{)8.755}$

7. A horse traveled 12.69 miles in 3 hours. How many miles did he average an hour?

8. During a three-hour rain storm 4.74 inches of rain fell. How much an hour was that on the average?

D



MOTOR-BOAT RACES

Each summer there were motor-boat races at Lake Calhoun. This is a map of the course, showing the distances between various points on the course.

1. How far is it from A to B?

2. Find the distance from A to C, by way of B.

3. In the same way find the distance from A to D; from A to E.

4. Find the entire length of the course.

5. A motor boat had reached C. Was it then halfway around the course? how much more or less?

6. When the boat had reached E, how much more than $\frac{3}{4}$ of the way was it?

7. Harry made the distance around the course in 30 minutes. What was his speed a minute?

8. Jack made the distance in 28 minutes 38 seconds. How much less time than Harry did Jack take?

9. George Brown went around the course 5 times in one afternoon. How many miles was this in all?

EFFECT OF MULTIPLYING NUMBERS BY 10, 100, AND 1,000

1. Compare the quotients in the following examples:

$16\overline{)384}$ $160\overline{)3,840}$ $1,600\overline{)38,400}$

2. How does the second example differ from the first?

3. What was done to both the divisor and the dividend of the first example to make the third example? Did this effect the value of the quotient?

From this work it is clear that both the divisor and dividend of an example may be multiplied by the same number without changing the value of the quotient.

Prove this rule in the following examples:

4. $25\overline{)625}$ **6.** $250\overline{)6,250}$ **8.** $2,500\overline{)62,500}$

5. $11\overline{)352}$ **7.** $110\overline{)3,520}$ **9.** $1,100\overline{)35,200}$

10. $\frac{\cdot 8}{\cdot 4} = \frac{8 \cdot 0}{4 \cdot 0} = \frac{8}{4}$. Why?

11. $.9 \div .3 = \frac{\cdot 9}{\cdot 3} = \frac{9 \cdot 0}{3 \cdot 0} = \frac{9}{3}$. Why?

An example like $8.6\overline{)78.4}$ can be changed to $86\overline{)784}$ by multiplying both divisor and dividend by 10. $\frac{78.4}{8.6} = \frac{784.0}{86.0} = \frac{784}{86}$. Instead of having a decimal for the divisor, there is a whole number. $8.6\overline{)78.4} = 86\overline{)784} = ?$

Change the divisor of each example to a whole number by multiplying in each example by 10, by 100, or by 1,000, as may be necessary. Be sure to multiply the dividend by the same number. Then find each quotient.

12. $.5\overline{).55}$ **14.** $.75\overline{).15}$ **16.** $.64\overline{)13.2}$ **18.** $8.5\overline{)59.5}$

13. $1.1\overline{).55}$ **15.** $.25\overline{)1.25}$ **17.** $7.3\overline{)3.65}$ **19.** $4.2\overline{)168}$

DIVIDING BY DECIMALS

1. Divide 17.03 by 1.3.

1.3)17.03	Change the divisor 1.3 to a whole number by shifting the decimal point one place to the right.
13.)170.3	The decimal point in 17.03 must also be shifted one place to the right.

Study the following examples:

A. .13)17.03 13.)1703.	How many places was the decimal point in A shifted to the right?
B. .13)170.3 13.)17030.	The decimal point in B is shifted two places in the divisor. Since there is only one decimal place in the dividend, one zero is put in so that the decimal point can be shifted two places.
C. .25)75. 25.)7500.	Since the decimal point is shifted two places in the divisor, two zeros are needed to fill in the places to the new decimal point in the dividend.

This work shows that the steps in dividing by decimals are:

a. Move the decimal point in the divisor as many places to the right as are necessary to change the divisor to a whole number.

b. Move the decimal point in the dividend the same number of places to the right. Annex zeros to fill in the empty spaces.

c. Place the decimal point in the quotient directly over the new decimal point in the dividend and divide as with whole numbers.

2. Find the quotients in A, B, and C.

3. $62.5 \div 2.5 = ?$ **7.** $1.771 \div 1.1 = ?$ **11.** $36.8 \div .08 = ?$

4. $7.65 \div 1.5 = ?$ **8.** $.169 \div 1.3 = ?$ **12.** $24 \div .12 = ?$

5. $1.44 \div .12 = ?$ **9.** $296 \div .4 = ?$ **13.** $6.5 \div .13 = ?$

6. $2.75 \div .5 = ?$ **10.** $37.5 \div .25 = ?$ **14.** $48 \div .24 = ?$

MORE DIFFICULT DIVISION OF DECIMALS

1. If a fast mail train travels a mile in 1.25 minutes, how many miles does it travel in 31.25 minutes?

25. 1.25∧)31.25∧ 25 0 6 25 6 25	In working long division examples with decimals, do not re-write the examples. Instead, use a ∧ to show how the decimal points have been shifted. The decimal point in the quotient is placed directly above the ∧ in the dividend. Place the decimal point in the quotient before you divide.

2. At the rate of 48.7 miles an hour, how long does it take a passenger train to travel 4 miles? $4 \div 48.7 = ?$

.082+ 48.7∧)4.0∧000 3 8 96 1 040 974 66	Here it is necessary to annex zeros, for there is a remainder in each division. After the work has been carried to three places, there is a remainder of 66. Since 66 is less than $\frac{1}{2}$ of 487, we write the quotient as .082 +. If the remainder had been more than $\frac{1}{2}$ of 487, we would write the quotient as .083 −. The time is .082+ hours.

Find the quotients. Check your work.

3. $6.2\overline{)19.84}$ **9.** $7.2\overline{)1.512}$ **15.** $.026\overline{)8.508}$ **21.** $39\overline{)4.0}$

4. $5.7\overline{)347.7}$ **10.** $54\overline{)491.4}$ **16.** $.097\overline{)40.74}$ **22.** $5.1\overline{)1.0}$

5. $.64\overline{)5.796}$ **11.** $74\overline{)62.16}$ **17.** $1.14\overline{)25.422}$ **23.** $84\overline{).79}$

6. $6.7\overline{)415.4}$ **12.** $2.6\overline{)18.278}$ **18.** $.21\overline{)196.812}$ **24.** $7.6\overline{)1.9}$

7. $.93\overline{)30.69}$ **13.** $.56\overline{)2.2792}$ **19.** $55\overline{)39.05}$ **25.** $9\overline{).17}$

8. $2.15\overline{)918.05}$ **14.** $.726\overline{)392.04}$ **20.** $37.5\overline{)753.75}$ **26.** $33\overline{)1.5}$

PLACING DECIMAL POINTS IN QUOTIENTS

1. In these examples are the decimal points in the quotients correctly placed?

$$2.7 \quad .25\overline{).675} \qquad .09 \quad 4\overline{).36} \qquad .11 \quad 3.2\overline{).352} \qquad 360. \quad .184\overline{)66.240} \qquad 56. \quad .25\overline{)14.00}$$

In the following examples the numbers in the quotients are correct. Where should the decimal points be placed? Be ready to read the answers.

2.	$.08\overline{)6.48}$	**9.**	$1.5\overline{)165}$	**16.**	$.84\overline{)3.024}$	**23.**	$.214\overline{)34.24}$
	81		11		36		160
3.	$.9\overline{)8.82}$	**10.**	$1.1\overline{)16.5}$	**17.**	$.13\overline{)16.9}$	**24.**	$0.6\overline{)738.6}$
	98		15		13		1231
4.	$.7\overline{).966}$	**11.**	$.12\overline{)1.44}$	**18.**	$.012\overline{)7.56}$	**25.**	$.5\overline{)45.}$
	138		12		630		90
5.	$.25\overline{).625}$	**12.**	$.21\overline{)4.83}$	**19.**	$4.5\overline{)94.5}$	**26.**	$1.57\overline{)7.536}$
	25		23		21		48
6.	$8.4\overline{)3.024}$	**13.**	$.11\overline{)2.2}$	**20.**	$2.1\overline{)6.72}$	**27.**	$.004\overline{)79.56}$
	36		20		32		19890
7.	$8\overline{)9.68}$	**14.**	$12\overline{)144}$	**21.**	$.121\overline{)5.203}$	**28.**	$30.1\overline{)42.14}$
	121		12		43		14
8.	$4\overline{)3.64}$	**15.**	$1.1\overline{)19.8}$	**22.**	$2.04\overline{)24.48}$	**29.**	$4.05\overline{)688.5}$
	91		18		12		170

Find the quotients:

30.	$2.5\overline{)6.25}$	**34.**	$3.01\overline{)42.14}$	**38.**	$2.1\overline{)483}$
31.	$.11\overline{)16.5}$	**35.**	$21.4\overline{)342.4}$	**39.**	$.12\overline{)75.6}$
32.	$1.21\overline{)5.203}$	**36.**	$.084\overline{)30.24}$	**40.**	$45\overline{)9.45}$
33.	$.157\overline{)75.36}$	**37.**	$.25\overline{).165}$	**41.**	$121\overline{)5.203}$

PROBLEMS ABOUT COAL

1. A cubic foot of water weighs 62.5 pounds. A cubic foot of bituminous coal weighs 1.3 times as much. Find the weight of a cubic foot of this coal.

2. A cubic-foot lump of Pennsylvania anthracite weighs 91.875 pounds. How many times as heavy as water is this?

3. Find the difference in weight between a cubic foot of bituminous coal and a cubic foot of anthracite.

4. In a recent year the anthracite miners dug, on the average, 2.1 tons of coal in a working day of 7.35 hours. How many hours did it take to dig one ton?

5. A miner was paid, on the average, \$7.35 a day. How much was he paid an hour? $\$7.35 \div 7.35 = ?$

6. How much did the coal company pay the miner for digging one ton of coal? $\$7.35 \div 2.1 = ?$

7. At the mine, anthracite was sold for \$5.67 a ton. How much more than it paid the miner did the coal company charge for the coal?

8. The freight rate from Scranton, Pennsylvania, to Chicago, Illinois, was \$5.67 a ton. Add this amount to the cost of the coal at the mine and find what the coal cost a dealer a ton delivered in Chicago.

9. The coal dealer in Chicago added, on the average, \$2.15 a ton to the price for handling it. What did the customers pay for a ton?

10. Find the cost of $7\frac{1}{2}$ tons of coal delivered to a customer in Chicago.

11. Mr. Jacks used 6.3 tons of anthracite one winter. At the rate found in problem **4**, how many hours would it take the miner to dig this amount of coal?

PRACTICE EXERCISES IN DIVISION OF DECIMALS

Practice the examples in each set until you can work all of them correctly. Be careful to place the decimal points in the quotients correctly.

Set I

	a	*b*	*c*	*d*
1.	$4\overline{)8.4}$	$2\overline{)6.8}$	$3\overline{)9.6}$	$2\overline{)4.2}$
2.	$3\overline{)7.47}$	$5\overline{)6.25}$	$7\overline{)9.24}$	$6\overline{)9.48}$
3.	$8\overline{)1.896}$	$9\overline{)1.728}$	$6\overline{)7.776}$	$5\overline{)8.365}$
4.	$2\overline{).8}$	$7\overline{).7}$	$4\overline{).76}$	$5\overline{).70}$
5.	$6\overline{).972}$	$5\overline{).645}$	$9\overline{).909}$	$4\overline{).628}$
6.	$4\overline{).12}$	$9\overline{).36}$	$6\overline{).042}$	$7\overline{).098}$
7.	$24\overline{)1.2}$	$55\overline{)1.1}$	$4\overline{)2}$	$16\overline{)8}$

Set II

1.	$25\overline{)64}$	$75\overline{)9.6}$	$66\overline{)1.74}$	$1.7\overline{)210}$
2.	$25\overline{)8.725}$	$21\overline{)6.867}$	$16\overline{)8.384}$	$31\overline{)8.153}$
3.	$.3\overline{)3.6}$	$.4\overline{)8.4}$	$.2\overline{)6.8}$	$.3\overline{)9.6}$
4.	$.3\overline{)18.63}$	$.7\overline{)17.99}$	$.5\overline{)14.45}$	$.9\overline{)34.56}$
5.	$.4\overline{)1.2}$	$.8\overline{)4.8}$	$.3\overline{)2.4}$	$.7\overline{)5.6}$
6.	$.3\overline{)6}$	$.4\overline{)8}$	$.4\overline{)3}$	$.8\overline{)6}$
7.	$.7\overline{)4}$	$.9\overline{)2}$	$1.9\overline{)6}$	$1.7\overline{)8}$

Set III

	a	*b*	*c*	*d*
1.	$.12\overline{)6}$	$.25\overline{)20}$	$.22\overline{)11}$	$.35\overline{)21}$
2.	$.16\overline{)12}$	$.28\overline{)7}$	$.20\overline{)15}$	$.12\overline{)3}$
3.	$.834\overline{)91.74}$	$.321\overline{)44.94}$	$.663\overline{)86.19}$	$.737\overline{)95.81}$
4.	$.11\overline{)1.21}$	$.16\overline{)1.92}$	$11\overline{)1.342}$	$.18\overline{)3.996}$
5.	$.17\overline{)8.5}$	$.32\overline{)916}$	$.13\overline{)9.1}$	$.18\overline{)5.4}$
6.	$1.25\overline{)6.75}$	$2.32\overline{)9.28}$	$2.46\overline{)1.38}$	$6.48\overline{)7.128}$
7.	$3.28\overline{)4.592}$	$.19\overline{)4.997}$	$47.9\overline{)52.69}$	$6.1\overline{)57.828}$

MIXED EXAMPLES IN DECIMALS

1. Find the sum of 7.5, 86.4, .75, and 568.
2. Subtract 8.5 from 76.4.
3. Subtract 9.8 from 27.75.
4. Multiply 2.5 by 4.7.
5. Multiply 4.86 by 2.01.
6. Find the product of 28 and .006.
7. $.8 \times .05 = ?$
8. Divide 1.44 by 12.
9. Divide 6.488 by 8.
10. $36.52 \div 1.1 = ?$
11. Divide 25 by .05.
12. Divide 974 by 37. Carry the work to three places.
13. $1{,}494 \div 9.4 = ?$
14. $\$733.36 \div \$7.12 = ?$
15. Add 7.96, .874, 37.2, and 4.6.

DIVIDING BY 10, 100, AND 1,000

1. Harry's father sold 100 bushels of apples for $200. How much did he receive a bushel? $200 ÷ 100 = $2.00.

2. He sold 10 bushels of pears for $25. How much did he receive a bushel? $25.00 ÷ 10 = $2.50.

When dividing a number by 10, *move the decimal point one place to the left.*

When dividing a number by 100, *move the decimal point two places to the left. Prefix zeros when necessary.* $6.00 ÷ 100 = $.06.

When dividing a number by 1,000 *move the decimal point three places to the left. Prefix zeros when necessary.* $6.00 ÷ 1,000 = $.006.

State the quotients:

3. 45 ÷ 10 =	**8.** 45 ÷ 100 =	**13.** 45 ÷ 1,000 =
4. 156 ÷ 10 =	**9.** 15.6 ÷ 100 =	**14.** 250 ÷ 1,000 =
5. 30.4 ÷ 10 =	**10.** 250 ÷ 100 =	**15.** 6,450 ÷ 1,000 =
6. .6 ÷ 10 =	**11.** 4.8 ÷ 10 =	**16.** 9,000 ÷ 1,000 =
7. 11.1 ÷ 10 =	**12.** 111 ÷ 100 =	**17.** 1,111 ÷ 1,000 =

18. A 100-pound tub of butter cost the grocer $48. What was the cost of a pound? of 10 pounds?

19. Ten tablets cost a stationer $.45. He sold them for $.70. The selling price of a tablet was how much more than the cost?

20. One hundred pounds of nails cost a hardware dealer $3.50. What was the cost a pound?

21. At the creamery 10 pounds of milk yielded .45 pound of butterfat. How much was this for a pound? for 100 pounds? for 1,000 pounds?

BUYING AND SELLING BY THE HUNDRED

Sugar, cotton, and many other articles are sold by the hundredweight (100 pounds—cwt.). Shipping rates are often expressed as a certain price a 100 pounds. Cigars, envelopes, and many other articles are sold by the hundred.

1. If envelopes cost \$.20 a hundred, how much must I pay for 75 envelopes? for 125 envelopes?

Think: 75 envelopes is $\frac{75}{100}$ or .75 of 100 envelopes.
75 envelopes cost $.75 \times \$.20 = \$.15$.
125 envelopes cost $1.25 \times .20 = \$.25$.

2. How much do 40 envelopes cost at \$.20 a hundred?

3. Henry bought 175 pounds of chicken feed for his prize flock of chickens. How much did the feed cost at \$3.20 a hundred pounds?

4. Marian's father sold a yearling steer, which weighed 900 pounds, for \$17.64 a hundred pounds. How much did he receive for the steer?

5. Arthur takes the milk to the creamery every morning. One morning the milk weighed 225 pounds. How much did he receive for it at \$4.08 a hundred pounds?

6. Helen bought a desk weighing 212 pounds. The freight was \$1.75 a hundred pounds. How much must Helen pay for freight?

7. On an automobile trip to the Grand Canyon John's father shipped their trunk by express to Grand Canyon, Arizona. The trunk weighed 204 pounds. How much did it cost to ship the trunk if the express rate was \$1.25 a hundredweight?

8. How much will it cost to paint the floor of a room 15 feet long and 30 feet wide at \$4.20 a 100 square feet?

Holstein Cow

Jersey Cow

TWO MILK RECORDS

Mary had a prize-winning Jersey cow, and her brother, Harry, had a prize-winning Holstein. Each day they made a careful record of the amount of milk from each of their cows. Here is the record for one month. It contains the total weight of the milk a week and the price a hundred pounds (cwt.) paid by the creamery.

Week	Mary's Cow		Harry's Cow		Price	Total	
	Lbs. Milk	Cwt.	Lbs. Milk	Cwt.		Mary's Cow	Harry's Cow
1.....	245	2.45	274	?	$2.40	?	?
2.....	273	?	292	?	$2.40	?	?
3.....	280	?	300	?	$2.48	?	?
4.....	275	?	286	?	$2.48	?	?
Total	?	?	?	?	?	?	?

1. Copy this record. Each question mark (?) in the record stands for a question which you are to answer. Find the answer. Replace each question mark by its corresponding answer.

2. Who received the larger amount of money and how much, Mary or Harry?

3. Which cow gave more milk and how much more?

CHANGING FRACTIONS TO DECIMALS

It is almost always easier to work with decimals than with common fractions. This exercise will show you how to change common fractions to decimals.

1. Change $\frac{7}{8}$ to a decimal.

.875 8)7.000	To change a fraction to a decimal, divide the numerator by the denominator. Divide 7 by 8. Annex zeros until there is no remainder. Check: $.875 = \frac{875}{1000} = \frac{7}{8}$

2. Change these common fractions to decimals. Check your work.

$\frac{3}{5}$; $\frac{4}{5}$; $\frac{3}{8}$; $\frac{5}{8}$; $\frac{9}{12}$; $\frac{3}{4}$; $\frac{1}{4}$; $\frac{9}{15}$; $\frac{11}{20}$

In changing some common fractions there is a remainder after the work has been carried to three places.

3. $\frac{8}{9}$ = what decimal?

$.888\frac{8}{9}$ 9)8.000	Here there is a remainder of 8 after the work has been carried to three places. The decimal is then written $.888\frac{8}{9}$. Usually the answer would be written .889, since $\frac{8}{9}$ is more than $\frac{1}{2}$. If the remainder had been 4, the answer would have been written .888, since $\frac{4}{9}$ is less than $\frac{1}{2}$.

4. Change these common fractions to decimals:

$\frac{2}{3}$; $\frac{5}{6}$; $\frac{1}{6}$; $\frac{9}{11}$; $\frac{8}{12}$; $\frac{9}{16}$; $\frac{7}{16}$; $\frac{7}{15}$

5. Copy the table on page 39 and change the fractions to decimals.

6. Find the answers to the questions in the exercise on page 39, using decimals instead of mixed numbers.

DECIMAL EQUIVALENTS OF EASY FRACTIONS

The following fractions are used very commonly in both the decimal and common fraction form. Learn the two forms of each.

$\frac{1}{2}$ = .5 or .50	$\frac{3}{5}$ = .6 or .60	$\frac{7}{8}$ = .87$\frac{1}{2}$ or .875
$\frac{1}{4}$ = .25	$\frac{4}{5}$ = .8 or .80	$\frac{1}{3}$ = .33$\frac{1}{3}$
$\frac{3}{4}$ = .75	$\frac{1}{8}$ = .12$\frac{1}{2}$ or .125	$\frac{2}{3}$ = .66$\frac{2}{3}$
$\frac{1}{5}$ = .2 or .20	$\frac{3}{8}$ = .37$\frac{1}{2}$ or .375	$\frac{1}{6}$ = .16$\frac{2}{3}$
$\frac{2}{5}$ = .4 or .40	$\frac{5}{8}$ = .62$\frac{1}{2}$ or .625	$\frac{5}{6}$ = .83$\frac{1}{3}$

1. An example like .75 × 96 can be worked in two ways.

With Decimals:	With Common Fractions:
96 .75 480 672 72.00	$\frac{3}{\cancel{4}}$ of $\cancel{\overset{24}{9}\overset{}{6}}$ = 72.
Which of these two ways is the easier?	

Find these products. Use both methods as a check on your work.

2.	.5 × 62 =	**13.**	.8 × 75 =	**24.**	.66$\frac{2}{3}$ × 21 =
3.	.12$\frac{1}{2}$ × 120 =	**14.**	.16$\frac{2}{3}$ × 54 =	**25.**	.2 × 74 =
4.	.33$\frac{1}{3}$ × 15 =	**15.**	.25 × 84 =	**26.**	.62$\frac{1}{2}$ × 64 =
5.	.6 × 43 =	**16.**	.37$\frac{1}{2}$ × 24 =	**27.**	.83$\frac{1}{3}$ × 36 =
6.	.125 × 24 =	**17.**	.4 × 35 =	**28.**	.75 × 28 =
7.	.87$\frac{1}{2}$ × 16 =	**18.**	.375 × 72 =	**29.**	.625 × 64 =
8.	3.75 × 12 =	**19.**	5.625 × 168 =	**30.**	7.66$\frac{2}{3}$ × 126 =
9.	.5 × 16 =	**20.**	.33$\frac{1}{3}$ × 27 =	**31.**	.25 × 156 =
10.	.25 × 700 =	**21.**	.66$\frac{2}{3}$ × 60 =	**32.**	.75 × 156 =
11.	.75 × 800 =	**22.**	.12$\frac{1}{2}$ × 64 =	**33.**	.33$\frac{1}{3}$ × 180 =
12.	.4 × 86 =	**23.**	.62$\frac{1}{2}$ × 48 =	**34.**	.66$\frac{2}{3}$ × 300 =

EVERYDAY USES OF DECIMALS

1. What is the distance around a rectangular piece of land 125.5 feet long and 186.9 feet wide?

2. In a three-hour race an automobile traveled 101.75 miles the first hour, 102.68 miles the second hour, and 104.37 miles the third hour. What was the average rate an hour?

3. A grain dealer had 15 tons of hay. He sold 4.5 tons to a farmer. How much hay did the grain dealer have left?

4. A farmer owned 125.75 acres of land. He sold 25.25 acres. How many acres did he then have?

5. An English pound (£) is valued at $4.8665. How much less than $5.00 is its value?

6. How many pounds are there in a load of hay weighing 1.375 tons?

7. A cubic foot of ice weighs 57.5 pounds. A cubic foot of water weighs 62.5 pounds. How much less than a cubic foot of water does a cubic foot of ice weigh?

8. Find the weight of a piece of ice 3 feet by 2 feet by 1.5 feet.

9. The average monthly rainfall in one of our states is 2.25 inches. What is the total yearly rainfall?

10. Alice's motor boat travels about .25 mile a minute. How far can it go in 15 minutes?

11. A bushel contains 1.25 cubic feet. How many cubic feet are there in 7.5 bushels?

12. An airplane traveled 426.5 miles in 5 hours. What was its average speed an hour?

13. Harry's father earns $7.20 in a 9-hour day. How much does he earn an hour?

14. Mary's mother used 9.75 yards of cloth to make three dresses for Mary. How many yards did she use for each dress?

15. A carpenter sawed a board 12.8 feet long into 4 equal pieces. How long was each piece?

16. Mr. Smith received $150.75 for 75 bushels of apples. How much did he receive a bushel?

17. If the cost of gasoline a mile used in Arthur's car is $.016, what will be the cost of gasoline for a trip of 60 miles? of 45 miles?

18. The distance across a lake is 1.68 miles. How far will a canoe go in making a trip across and back again?

19. A passenger train travels at an average speed of 32.75 miles an hour. How far does it travel in 3.7 hours?

20. Our cottage is 7.5 miles from the center of the city. If we walk there from home in 3 hours, how many miles an hour do we walk?

21. The Panama Canal is 50.44 miles long. The Suez Canal is 102.9 miles long. How much longer than the Panama Canal is the Suez Canal?

22. A quart of milk weighs 2.155 pounds, and a quart of water weighs 2.09 pounds. Find the difference in weight.

23. On a 10-acre field Arthur grew 375 bushels of corn. How many bushels an acre was that?

24. On an automobile trip last year Julia's father traveled 175.5 miles in 12.5 hours. How many miles an hour on the average did he travel?

25. The cyclometer on Harry's bicycle shows that the distance from home to school is 1.2 miles. If Harry rode to school in 4 minutes, what was his speed in miles a minute?

USES OF DECIMALS IN GOVERNMENT REPORTS

Decimal fractions are nearly always used in government reports. Common fractions seldom are found. The table below is part of one printed in a report of the Weather Bureau for a city in the United States.

	Average Temperature			
Month	1900	1910	1920	Average
January	33.2	32.4	24.1	?
March	35.0	44.7	40.6	?
May	60.8	60.2	57.8	?
July	76.4	77.8	72.5	?
September	70.8	68.4	67.4	?
November	48.7	41.6	44.2	?
Average for the 6 months	?	?	?	

1. In what month in each year was the temperature highest?

2. In what month was the temperature lowest each year?

3. Find the average temperature for the six months for each year.

4. In which months each year was the temperature below the average for the year? In which months was it higher than the average?

5. How much lower than the temperature for January 1910 was the temperature for January 1920? how much lower than the temperature for January 1900?

6. What was the average temperature for each month for the three years?

*7. Make a copy of the table at the beginning of the exercise, but express the decimals as common fractions. Find the answers to questions **3** and **6**, using your own table. Which table is easier to work with?

USING DECIMALS IN DIVISION OF MIXED NUMBERS

1. You have learned how to divide $87\frac{1}{2}$ by 5. It is much easier to work this example using the decimal form.

17.5 5)87.5	Think: $87\frac{1}{2} = 87.5$ Divide as with whole numbers. Place the decimal point in the quotient directly over the decimal point in the dividend. Check: $17\frac{1}{2} \times 5 = 87\frac{1}{2}$

2. Divide $91\frac{1}{5}$ by 4. Think: $91\frac{1}{5} = 91.2$

3. Divide $16\frac{3}{4}$ by 5; by 15; by 25.

4. Divide $12\frac{3}{5}$ by 6; by 4; by 20; by 25.

5. Divide $1\frac{1}{4}$ by 5; by 2; by 25; by 15.

6. Divide $2\frac{4}{5}$ by 7; by 4; by 14; by 2.

7. Divide $4\frac{1}{2}$ by 9; by 3; by 2; by 15.

Find the quotients.

8. $62\overline{)198.4}$

9. $57\overline{)34.77}$

10. $.63\overline{)57.96}$

11. $67\overline{)415.4}$

12. $9.3\overline{)306.9}$

13. $74\overline{)6.216}$

14. $2.5\overline{)375}$

15. $1.5\overline{).1695}$

16. $7.2\overline{)15.12}$

17. $5.4\overline{)491.4}$

18. $.74\overline{)62.16}$

19. $26\overline{)182.78}$

20. $5.6\overline{)2279.2}$

21. $.36\overline{)302.4}$

22. $51\overline{)3.723}$

23. $8.4\overline{)3{,}025}$

24. $26\overline{)8.508}$

25. $.114\overline{)254.22}$

26. $.21\overline{)196.812}$

27. $9.7\overline{)40.74}$

28. $.55\overline{)390.5}$

29. $.73\overline{)372.3}$

30. $1.25\overline{)312.5}$

31. $.025\overline{)31.25}$

USING FRACTIONS TO COMPARE NUMBERS

Sometimes it is convenient to compare numbers, or sizes, without getting exact comparisons as you have been doing.

1. What do we mean when we say, "About $\frac{1}{2}$ hour" or "about $\frac{3}{4}$ of a mile"?

2. A coat costs \$10 and a hat costs \$4.95. About how many times as much as the hat does the coat cost?

3. Is \$4.95 about $\frac{1}{2}$ or $\frac{1}{4}$ of \$10?

4. What are the correct answers in the five problems below?

a. \$3.10 is about $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{6}$ of \$6.
b. \$2.95 is about $\frac{1}{3}$; $\frac{1}{4}$; $\frac{1}{2}$; $\frac{1}{5}$ of \$15.
c. 30 is about $\frac{1}{4}$; $\frac{1}{5}$; $\frac{1}{2}$; $\frac{1}{6}$ of 149.
d. 58 is about $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{5}$ of 220.
e. 52 is about $\frac{3}{7}$; $\frac{5}{7}$; $\frac{1}{3}$ of 70.

Fractions can be used to compare large numbers.

5. Is 990 about $\frac{1}{2}$ or $\frac{1}{3}$ of 2000?

Think: $\frac{990}{2000}$ is about $\frac{1000}{2000}$ or $\frac{1}{2}$ when reduced to lowest terms.

6. Compare 1,475 and 3,000.

Think: 1,475 is about 1,500. 1,500 is $\frac{1}{2}$ of 3,000. So 1,475 is about $\frac{1}{2}$ of 3,000.

7. Compare 2,850 and 9,000.

8. Compare 4,600 and 3,900.

9. The population of Town A is 15,000 and of Town B is 149,000. Express the comparison of the populations by a simple fraction.

Think: $\frac{15000}{149000}$ = approximately what simple fraction?

10. The area of Lake Placid is 3,490 square miles and of Lake Blue, 6,985 square miles. Express the comparison by a simple fraction: $\frac{3490}{6985}$ = approximately what?

USING DECIMALS IN MEASURING

Surveyors use steel tapes to measure land. Instead of being divided into feet and inches, each foot on the tape is divided into 100 equal parts. Each of these small parts is $\frac{1}{100}$ foot or .01 foot long.

1. Draw a line 1 inch long. Divide it into 10 equal parts. What fraction of an inch is each part?

2. Draw a line 1 foot long. Divide it into 10 equal parts. What fraction of a foot is each of the 10 equal parts? How many inches long is each part?

3. Which is longer and how much longer, .1 foot or 1 inch?

4. Which is longer and how much longer, .5 foot or 6 inches?

5. Express 1.75 feet as inches.

6. A surveyor measured a piece of valuable land in the business section of a city and found that it was 46.73 feet wide and 84.50 feet deep. How much greater than its width was its depth?

7. Two surveyors measured the length of a piece of land. One said it was 95.75 feet long, and the other said that it was 95.68 feet long. What was the difference between their measurements?

8. What is the distance around a piece of land 67.53 feet by 47.09 feet? What is its area?

9. Mr. Smith said, "This piece of land is 65.38 feet long, or 65.4 feet carried to the nearest tenth of a foot, and 65 feet to the nearest foot." Express the following lengths to the nearest tenth of a foot: 3.76 ft., 5.19 ft., 6.41 ft., 4.67 ft., 6.08 ft., 7.02 ft.

MAKING TICKETS

1. The sixth-grade pupils were making tickets for their hobby show. They measured some tickets and found them to be $3\frac{1}{2}$ inches long and $1\frac{7}{8}$ inches wide. They decided to make their tickets this size. How many square inches were in each ticket?

2. The sheets of cardboard from which they cut the tickets were 30 inches long and 22 inches wide. How many square inches were in one of these sheets? $\frac{1}{2}$ sheet? $\frac{1}{4}$ sheet? $\frac{1}{8}$ sheet?

3. The pupils ruled the sheets crosswise in strips $1\frac{7}{8}$ inches wide. How many of these strips are there in each sheet?

4. They cut each of the strips into tickets $3\frac{1}{2}$ inches long. How many tickets did they get from each strip?

5. How much will be left of each strip after they have cut off all the tickets they can?

6. How many tickets $3\frac{1}{2}$ inches long and $1\frac{7}{8}$ inches wide can be cut from a sheet of cardboard 35 inches long and 15 inches wide?

7. How many tickets $2\frac{1}{2}$ inches long and $1\frac{5}{16}$ inch wide can be cut from a piece of cardboard of the size given in problem **6.**

COMPARING THE AREAS OF THE GREAT LAKES

1. Which of these five lakes is the largest?

2. Rank the lakes in the order of their size.

3. About how many times as large as Lake Erie is Lake Superior?

4. About how many times as large as Lake Ontario is Lake Michigan?

5. How does Lake Huron compare in size with Lake Superior?

6. In your geography book consult the table showing the area of the states. Which state is about equal in size to Lake Superior?

7. What states are approximately equal in area to each of the other lakes?

8. The area of the Mediterranean Sea is about 813,000 square miles. How many times as large as the total area of the great lakes is the area of the Mediterranean Sea?

9. How does the area of Lake Superior compare with the area of Rhode Island? of New York? of California? of Florida?

10. Is Lake Ontario equal to about $\frac{1}{2}$, $\frac{1}{3}$, or $\frac{1}{4}$ of Lake Michigan?

11. Is Lake Erie equal to about $\frac{1}{2}$, $\frac{1}{3}$, or $\frac{1}{4}$ of Lake Superior?

12. Is Lake Michigan about equal to $\frac{1}{2}$, $\frac{2}{3}$, or $\frac{5}{6}$ of Lake Superior?

***13.** Use reference tables in your geography book to find a state that is about double the area of each of the lakes.

***14.** Find a state that is about three times the area of each of these lakes.

A COMPLETION EXERCISE

In each of the following problems there is something missing. Number lines on your paper from 1 to 18. After each number write the word or number that is missing.

1. The decimal form of $\frac{3}{4}$ is ——.

2. The fractional form of .25 is ——.

3. .06 is read: six ——.

4. .025 is read: twenty-five ——.

5. $5\frac{1}{2}$ expressed in decimal form is ——.

6. 4.8 expressed as a mixed number is ——.

7. The inverted form of $\frac{5}{8}$ is ——.

8. The inverted form of $1\frac{2}{3}$ is ——.

9. The inverted form of 5 is ——.

10. When changed to an improper fraction, $4\frac{2}{3}$ equals——.

11. To change $\frac{7}{8}$ to a decimal —— 7 by 8.

12. To find what part 6 is of 15 divide —— by ——.

13. 25 is —— of 75.

14. The ratio of 8 to 4 is ——.

15. The ratio of 5 to 10 is ——.

16. $.5 \times .5 =$ ——.

17. The sum of .6, .7, and .7 is ——.

18. The difference between 4 and 3.25 is ——.

PRACTICE WITH DECIMALS

Add these numbers:

1. 4.7, 5.24, 6.78, 7.432, 5.1, .9
2. .01, 7.2, .465, 92.8, 74.12
3. 46.2, 8.3, .002, 4.96, 52
4. 4, .04, .4, .004, 44

Subtract these numbers. Work carefully.

5. 4.8 − 1.5 =
6. 5.63 − 4.27 =
7. .24 − .17 =
8. 13.6 − 4.25 =
9. 83.273 − 42.15 =
10. 5.241 − .47 =

Multiply these numbers. Watch the decimal points.

11. 1.4 × 21 =
12. 5.2 × .74 =
13. 9.6 × 30 =
14. .523 × 14 =
15. 63 × .007 =
16. 8.7 × 4.65 =

Divide these numbers. Watch the decimal points.

17. 37.5 ÷ 3 =
18. 4.84 ÷ 4 =
19. 7.46 ÷ .4 =
20. 8.55 ÷ .09 =
21. 6.224 ÷ .8 =
22. 27.08 ÷ 1.2 =
23. 6.75 ÷ 15 =
24. 11.025 ÷ 63 =
25. .169 ÷ .013 =
26. 5752.5 ÷ .025 =

ABOUT MAPLE SUGAR

Ned lived on a farm in Vermont. His father had a grove of sugar maples, or a "sugar orchard" as it is called there.

1. In sugar orchards there are, on the average, about 75 trees to the acre. In Ned's father's orchard there were 14 acres. About how many trees were there in the grove?

2. Ned found that it took a barrel of sap to make a gallon of sirup. A barrel contains 31.5 gallons. How many gallons of sap did it take to make 16 gallons of sirup? 28 gallons? 30 gallons?

3. A fair yield for a tree is $\frac{1}{2}$ gallon of sirup. Express $\frac{1}{2}$ as a decimal.

4. How many gallons would 100 trees yield at this rate?

5. A gallon of sirup makes about 6.5 pounds of sugar. How many pounds of sugar will 80 gallons make?

6. One spring Ned found that 100 trees produced 329 pounds of sugar. What was the average yield a tree?

7. Ned received 26¢ a pound for this sugar. What did he receive for all of it?

8. What was the value of the average yield of Ned's 100 trees?

9. Some of the sap was made into sirup, put up into gallon cans, and sold for $2.00 a can. The cans used cost $.12 each. What was the net price Ned's father received for 65 gallons of sirup?

10. If this 65 gallons of sirup had been made into sugar, how many pounds of sugar would it have produced?

11. If this sugar had been sold for $.25 a pound, what would Ned's father have received?

12. Use your answers to problems **9** and **11** to find out

whether it was better to sell the product of the sugar orchard as sirup or as sugar.

13. Taking 1,050 as the number of trees in the sugar orchard and remembering that a tree yields, on the average, $\frac{1}{2}$ barrel of sap, find:

a. The number of barrels of sap produced in the orchard.

b. The number of gallons of sirup that this sap would make. (See problem **2.**)

c. How many pounds of sugar this sirup will produce.

DIAGNOSTIC TEST NO. II

1. $\frac{3}{4} + \frac{5}{6} + 1\frac{1}{12} = ?$

2. Subtract $14\frac{1}{5}$ from $85\frac{1}{10}$.

3. $4\frac{1}{2} \times 6\frac{2}{3} \times 5 = ?$

4. $5\frac{1}{3} \div 4 = ?$

5. Find the product of 584 and 975.

6. Divide 534,876 by 841.

7. Find $\frac{7}{8}$ of 50.

8. Change $3\frac{1}{2}$ feet to inches.

9. Find the area of a field 180 rods by 160 rods.

10. Find the average of 98, 75, 64, 52, and 186.

11. $18 = 72 \div ?$ $\qquad 3\frac{1}{2} = 7 \times ?$

12. $100 \times 3.5 = ?$ $\qquad 10 \times .605 = ?$

13. Find the sum of 7.8, .965, 47.9, and 86.74.

14. Subtract 8.625 from 62.1.

15. Multiply 7.24 by .95.

16. Divide 49.14 by 5.4.

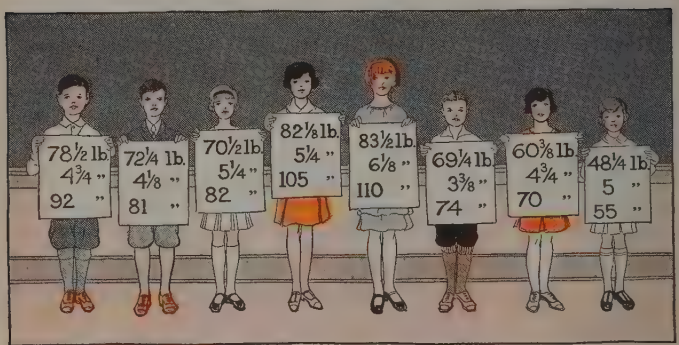
17. $.06 \times 100 = ?$

18. $.24 \times 300 = ?$

19. $1.05 \times 464 = ?$

20. Express $\frac{7}{12}$ as a decimal; .05 as a common fraction.

THE RESULTS OF A HEALTH PROGRAM



Two months ago these boys and girls were all underweight for their age and height.

The upper number shows what each weighed two months ago. The middle number shows what each has gained in the two months. The lower number on the card shows what each should weigh.

1. Find the present weight of each child. Make a table showing the weights.

2. How much more has each yet to gain in order to weigh just what he or she should? Make a table showing these amounts.

3. Which child made the greatest gain? How much more than each of the other children did she gain?

4. Which child gained the least? How much less than each of the other children did he gain?

5. Find the average gain a month for each child. Which child had the largest average gain?

*6. Do you weigh as much as you should?

D

PRACTICE TESTS IN THE FUNDAMENTALS

You should be able to find the answers to the examples in each of the following sets and to check your work in the time allowed. When necessary to copy, do so before counting time.

Addition Test (8 minutes)

1.	2.	3.	4.	5.	6.
684	235	693	849	331	996
336	250	164	607	349	811
956	792	845	942	285	982
742	877	452	358	466	513
493	978	749	516	588	241
536	769	789	799	417	918

Subtraction Test (4 minutes)

1.	3.	5.	7.	9.	11.
9,317	9,361	7,493	8,802	8,921	9,727
4,432	4,327	2,628	1,326	5,896	2,030

2.	4.	6.	8.	10.	12.
9,322	8,362	8,431	5,244	8,510	7,456
3,345	1,799	4,988	2,579	5,889	4,679

Multiplication Test (8 minutes)

1.	3.	5.	7.	9.	11.
395	269	179	735	417	281
74	28	93	56	704	65

2.	4.	6.	8.	10.	12.
147	268	268	853	946	534
82	39	47	208	506	309

Division Test (8 minutes)

1. $46\overline{)16,422}$	3. $85\overline{)27,115}$	5. $39\overline{)28,509}$	7. $64\overline{)60,224}$
2. $27\overline{)10,395}$	4. $58\overline{)15,892}$	6. $98\overline{)49,784}$	8. $85\overline{)81,260}$

Use these tests for special practice from time to time.

PRACTICE TESTS IN FRACTIONS

You should be able to find the answers to the examples in each of the following tests in less than 10 minutes.

Addition Practice Test I

1. $\frac{1}{3}$ + $\frac{1}{3}$ =
2. $2\frac{3}{5}$ + $3\frac{4}{5}$ =
3. $\frac{1}{4}$ + $\frac{1}{3}$ =
4. $\frac{3}{4}$ + $\frac{3}{4}$ =
5. $\frac{1}{2}$ + $\frac{1}{6}$ =
6. $\frac{3}{5}$ + $\frac{1}{2}$ + $\frac{1}{4}$ =
7. $\frac{2}{3}$ + 7 =
8. $1\frac{1}{2}$ + $\frac{3}{4}$ =
9. $1\frac{1}{6}$ + $7\frac{3}{5}$ + $3\frac{1}{6}$ =
10. $2\frac{1}{4}$ + $\frac{1}{4}$ + 4 =
11. $1\frac{1}{4}$ + $\frac{1}{4}$ + $2\frac{1}{2}$ =
12. $5\frac{3}{5}$ + $7\frac{1}{4}$ + $\frac{1}{4}$ =

Subtraction Practice Test I

1. $\frac{2}{3} - \frac{1}{3}$ =
2. $6\frac{1}{4} - 6\frac{1}{8}$ =
3. $5\frac{5}{6} - \frac{1}{6}$ =
4. $7\frac{3}{5} - 1\frac{1}{10}$ =
5. $3\frac{3}{4} - 2\frac{3}{4}$ =
6. $7\frac{1}{9} - \frac{1}{4}$ =
7. $1\frac{1}{4} - \frac{3}{4}$ =
8. $5\frac{1}{5} - \frac{2}{3}$ =
9. $6\frac{1}{3} - \frac{2}{3}$ =
10. $\frac{3}{4} - \frac{1}{6}$ =
11. $4\frac{1}{6} - 1\frac{5}{6}$ =
12. $4\frac{5}{6} - 1\frac{2}{5}$ =

Multiplication Practice Test I

1. $\frac{1}{4} \times 8$ =
2. $\frac{1}{2} \times \frac{7}{10}$ =
3. $\frac{2}{5} \times 3\frac{2}{3}$ =
4. $6\frac{1}{4} \times 6\frac{2}{5}$ =
5. $\frac{5}{6} \times 14$ =
6. $7 \times 4\frac{1}{2}$ =
7. $5\frac{3}{8} \times 6 \times 2\frac{1}{3}$ =
8. $24 \times 3\frac{1}{8}$ =
9. $8 \times \frac{1}{6}$ =
10. $2\frac{1}{4} \times \frac{1}{4}$ =
11. $7\frac{1}{2} \times \frac{2}{5}$ =
12. $23 \times 8\frac{2}{5}$ =

Division Practice Test I

1. $5 \div \frac{1}{3} =$	**5.** $2 \div \frac{4}{5} =$	**9.** $\frac{13}{15} \div \frac{1}{2} =$
2. $1\frac{3}{8} \div \frac{3}{10} =$	**6.** $\frac{5}{6} \div 4 =$	**10.** $1\frac{1}{3} \div 5 =$
3. $4\frac{2}{5} \div 6 =$	**7.** $\frac{1}{6} \div 1 =$	**11.** $7 \div 12 =$
4. $1\frac{1}{5} \div 3\frac{1}{2} =$	**8.** $6\frac{2}{3} \div \frac{2}{3} =$	**12.** $3\frac{3}{8} \div 1\frac{1}{4} =$

Practice these tests until you can work all of the examples correctly in the time allowed.

PRACTICE TEST IN DECIMALS I

You should be able to find the answers to the following examples in less than 10 minutes.

1. Express as decimals: $\frac{1}{2}$; $\frac{1}{4}$; $\frac{7}{8}$; $\frac{4}{5}$.

2. Express as common fractions: .3; .25; .2; .125.

3. Find the sum of 8.6; 9.12; 5; .135; and 12.375.

4. Subtract: (*a*) 13.75 from 13.8; (*b*) 3.25 from 18.

5. Multiply: (*a*). 6×4; (*b*) 4.7×6.25; (*c*) 100×7.32.

6. Divide: (*a*) $3\overline{)7.296}$; (*b*) $.07\overline{)8.54}$; (*c*) $834\overline{)91.74}$.

Practice these examples until you can work all of them correctly in the time allowed.

PROBLEM SCALE II

1. A charitable lady divided 8 pies equally among 4 families. In one family there were 8 people. What part of a pie would each of these persons receive?

2. Jack wished to earn \$18.50 to buy a new bicycle. One Saturday he worked $7\frac{3}{4}$ hours for \$.40 an hour. How much more must he earn before he can buy the bicycle?

3. If Frank works for Mr. Smith $\frac{3}{4}$ of an hour before school and $1\frac{1}{2}$ hours after school each day, how many hours does he work for him during a school week? (5 days.)

4. Harry had an order for $4\frac{1}{4}$ bushels of cherries. In the morning he picked $2\frac{3}{4}$ bushels and in the afternoon $3\frac{3}{4}$ bushels. How many more than he needed did he pick?

Standards	
Excellent	9 or 10 correct
Good	7 or 8 correct
Fair	5 or 6 correct
Unsatisfactory	0 to 4 correct

5. Before starting on a trip, Mr. Andrews filled the 10-gallon tank on his car. After a 50-mile trip he had $7\frac{1}{2}$ gallons. How many miles did his car travel using one gallon of gasoline?

6. Mrs. Andrews bought 3 chickens at the butcher shop. One weighed $3\frac{1}{4}$ pounds, one weighed $2\frac{3}{4}$ pounds, and one weighed $4\frac{1}{2}$ pounds. Find their average weight.

7. If $1\frac{3}{4}$ bushels of peas are needed to plant an acre, how much will the seed for a 10-acre field cost at $3 a bushel?

8. Jack gave half of the $4\frac{1}{2}$ pounds of pecans he had picked to Harry. If Harry already had $1\frac{1}{2}$ pounds of pecans, how many did he then have in all?

9. Mrs. Smith divided the candy from four $1\frac{1}{2}$-pound boxes equally among 8 children. How much did the candy weigh which each one received?

10. The average number of bushels of wheat an acre in the United States is $14\frac{1}{2}$. On a 10-acre field Mr. Smith raised 136 bushels of wheat. How much less an acre than the average was this?

D

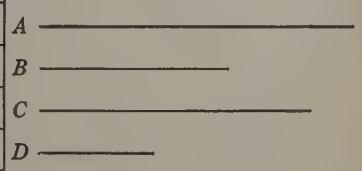
CHAPTER III

ESTIMATING AND MEASURING LENGTH

1. Four boys measured the length of their classroom, each using his own method of measuring. One used a foot ruler, one a yardstick, one a piece of string, and one measured by counting the number of $2\frac{1}{2}$-foot steps it took him to walk the length of the floor. Try these four methods before you give your answer to the following questions. Which one measured the room the most accurately? Why?

2. Estimate the length of these lines in quarter inches. Then measure their length with a ruler. Find your error. Use this table to record your results. If your estimate is too long, mark your error $+$. If it is too short, mark your error $-$.

Line	Estimate	Measure with Ruler	Error
A			
B			
C			
D			



3. Without a ruler, draw lines that you think are $1\frac{7}{8}$ inches, $5\frac{1}{2}$ inches, and $6\frac{3}{4}$ inches in length. Then measure them with a ruler. Use a table like the one in problem **2** to record your results.

4. Estimate the width and the height of the door in your classroom, the width of the blackboard, and the width of your desk. Then measure them and find your error.

***5.** The *Santa Maria*, flagship of Columbus, was 128 feet long and 25 feet beam (width). Measure off a space 128 feet long and 25 feet wide.

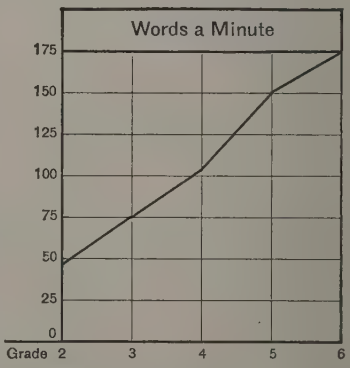
***6.** Measure off a piece of ground that contains 160 square feet.

***7.** Find a box and measure its inside dimensions. Then find its capacity.

***8.** Estimate the area of the floor of your classroom. Check your estimate.

A SCHOOL GRAPH

This is a graph of the number of words read a minute by the children in the Hamson School.



1. For what grades are scores given on the graph?

2. Did the fourth grade read more rapidly than the third grade? How can you tell?

3. What grades read less than 100 words a minute?

4. What grades read more than 100 words a minute?

5. What grades read more than 125 words a minute?

6. How many words can you read in a minute?

***7.** Find graphs in newspapers or secure some that are used in your school. Be ready to explain them to the class.

AN INTERURBAN TIME-TABLE

Harry lived near an interurban line. The cars passed his house every 10 minutes from 6:10 A.M. to 7:50 A.M., every 15 minutes from 7:50 A.M. to 3:50 P.M., and every 10 minutes from 3:50 P.M. to 6:30 P.M.

1. Make a schedule showing the time when the cars passed Harry's house between 6:10 A.M. and 6:30 P.M.

2. How many cars ran to the city each hour between 6:10 A.M. and 7:50 A.M.

3. How many cars an hour were there from 7:50 A.M. to 3:50 P.M.?

4. The trip to the railroad station took 25 minutes. When will each car reach the depot?

5. Harry's sister, who worked in the city, left the city at 5:45 P.M. When did the car reach her home?

UNITS OF TIME

By what unit of time would you measure:

1. the time in which a sprinter can run 100 yards?

2. the time it takes the earth to revolve around the sun?

3. the time you are in school each day?

4. the age of a man?

5. the age of a very young baby?

6. the length of time since Washington was born?

7. the length of time in which a racing automobile can travel a mile?

8. the time since the birth of Christ?

***9.** What ways were there of telling time before there were watches such as we have today?

WEIGHTS OF PORTIONS OF FOOD

1 cup butter	= ½ lb.	1 pt. milk	= 1 lb.
1 cup corn meal	= ⅝ lb.	1 cup raisins	= ¾ lb.
1 egg	= ⅛ lb.	1 cup sugar	= ½ lb.
1 cup flour	= ¼ lb.	1 qt. water	= 2 lb.

1. One cup of butter weighs —— pound more than 1 cup of flour.

2. One egg weighs —— pound less than 1 pint of milk.

3. One cup of raisins weighs —— pound less than 1 cup of butter.

4. A cup of sugar and a pint of milk together weigh —— pounds.

5. One quart of water weighs as much as —— pints of milk.

6. A cup of flour weighs —— pound more than an egg.

7. A quart of milk weighs —— pounds.

8. Two cups of flour weigh —— pound.

9. Two eggs weigh —— pound.

10. Two cups of sugar weigh —— pound.

11. One pound of raisins is about —— cups.

USEFUL MEASUREMENTS

Write the answers to the following examples:

1. 112 in. = ? ft.
2. 2 lb. = ? oz.
3. 1 mi. = ? yd.
4. 3 sq. yd. = ? sq. ft.
5. 1 cu. ft. = ? cu. in.
6. 2 t. = ? cwt.
7. 8 qt. = ? pt.
8. 16 ft. = ? yd.
9. 8 pk. = ? bu.
10. 5 min. = ? sec.
11. 1 sq. ft. = ? sq. in.
12. 7 yd. = ? ft.
13. $5\frac{1}{2}$ yd. = ? rd.
14. 2 rd. = ? ft.
15. 27 cu. ft. = ? cu. yd.
16. 3 gal. = ? qt.

SHORT TESTS IN MIXED PROCESSES

Test I

1.
867
456
877
385
877
439

2.
39.85
−17.86

3.
$\frac{3}{8}$
$\frac{4}{5}$
$+\ \frac{1}{6}$

4. $9\frac{1}{2} \div 3\frac{1}{4} =$

5. $.25\overline{)7.8}$

6.
59.462
− 28.5

7.
59.7
× 7.4

Test II

1.
897
966
259
976
689
598

2. Subtract $6\frac{1}{4}$ from $4\frac{2}{3}$

3.
3.75
× .04

4. $4\frac{1}{2} \times 3\frac{1}{3} \times 4 =$

5. $1.6\overline{)8.48}$

6.
86.4
− 3.975

7. $3\frac{1}{3} \div 2 =$

Test III

1. Add 16.7, 9.75, 88.95, .004, and 60.
2. Subtract five and one eighth from ten and one tenth.
3. Multiply seven hundredths by nine tenths.
4. Divide 3.725 by 15.
5. Subtract 4.375 from 16.5.
6. Multiply $3\frac{3}{4}$ by $2\frac{2}{5}$.
7. Divide 69,728 by 354.

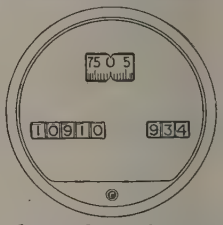
Test IV

1. Add 4.75, 2.5, 1.674, 48, and .9.
2. Subtract $8\frac{3}{4}$ from 15.7.
3. Multiply: $\frac{3}{4} \times \frac{9}{10} \times 3\frac{1}{8}$.
4. Find the product of 7.8 and 3.48.
5. Divide $5\frac{2}{5}$ by $\frac{3}{5}$.
6. Divide 984 by .48.
7. Change to common fractions: .75, .4, .375, $.33\frac{1}{3}$.

THE SPEEDOMETER

Jack made a copy of the readings of the speedometer on his father's automobile. This is the record for a week.

Total	Daily Readings	
10,384	00.0	Monday morning
10,471	87.3	Monday evening
10,562	91.5	Tuesday evening
10,646	83.4	Wednesday evening
10,734	87.9	Thursday evening
10,817	82.9	Friday evening
10,910	93.4	Saturday evening



1. Find in two different ways the total number of miles that the car was driven during the week. Do they check?

2. How many more miles was the car driven on Saturday than on Thursday?

3. What was the average number of miles that the car was driven daily during the week?

4. How many more miles must the car be driven before the speedometer will register 11,000 miles?

5. The car runs, on the average, 18.3 miles to a gallon of gasoline. How many gallons of gasoline were used on Tuesday? on Saturday?

6. If Jack's father drives the same number of miles each week as he did this week, how far will he drive in 10 weeks?

USING DECIMALS TO COMPARE

1. What is the ratio of the speed of a steamship which travels 25 miles an hour and the speed of a railroad train which travels 40 miles an hour?

$25 \div 40 = \frac{25}{40} = \frac{5}{8}$ $\frac{25}{40} = \frac{5}{8} = .625$	Think: What is the ratio of 25 to 40? This ratio may also be expressed as a decimal by changing $\frac{25}{40}$ to a decimal.

Express the following ratios as decimals.

2. The ratio of 6 pounds to 8 pounds = ?

3. The ratio of 9 pounds to 15 pounds = ?

4. The ratio of 6 pounds to 4 pounds = ?

5. The ratio of 12 pounds to 10 pounds = ?

6. Mary paid \$.60 for the material in an apron. She sold the apron for \$.90. What is the ratio of the cost of the material to the selling price of the apron?

7. Harry paid $1\frac{1}{4}$¢ for a *Journal* and sold it for 2¢. What is the ratio of the cost price to the selling price?

8. A grocer sold potatoes for \$2.00 a bushel. He paid \$1.60 for them. What is the ratio of the selling price to the cost?

9. What is the ratio of 6.25 hours to 3.125 hours?

10. About 12 bushels of potatoes are needed for seed for one acre. What is the ratio of the seed to a yield of 96 bushels an acre?

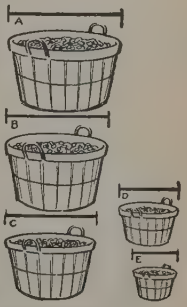
COMPARING CROPS

1. The wheat yield in bushels an acre in different countries is given at the right. How many bushels an acre are produced by each of these countries?

2. How many more bushels an acre are raised in Belgium than in the United States? than in France?

3. How much less an acre is raised in the United States than in Great Britain?

4. Does the United States raise half as much an acre as Belgium?



Wheat yield an acre in bushels

A. Belgium 38.0
B. Germany....34.3
C. Great Britain and Ireland .31.3
D. France.....20.4
E. United States 15.5

5. What country raises about two times as much wheat an acre as the United States?

***6.** How do the pictures of bushel baskets help show the facts about wheat?

BUYING AND SELLING BY WEIGHT

1. A load of hay contained 2,640 pounds. What did it sell for at $15 a ton?

To find how many tons there are in 2,640 pounds, divide that number by 2,000, the number of pounds in a ton, and carry the work to three places if necessary.

2. Find the value of 3,200 pounds of hay at $12.50 a ton.

3. A wagon load of coal contained 2,500 pounds. What is the value of the load at $18.40 a ton?

Think: Five hundred pounds = what part of a ton?

Express the following as tons and parts of tons. Use decimals or common fractions as seems best.

4. 2,400 lb. **7.** 2,800 lb. **10.** 3,000 lb. **13.** 500 lb.

5. 2,560 lb. **8.** 3,240 lb. **11.** 6,754 lb. **14.** 750 lb.

6. 2,250 lb. **9.** 2,750 lb. **12.** 3,250 lb. **15.** 1,500 lb.

Find the cost of:

16. 800 lb. at $10 a ton.

17. 2,200 lb. at $18 a ton.

18. 3,500 lb. at $16.50 a ton.

19. 2,480 lb. at $17.50 a ton.

20. Find the value of three loads of coal at $13.50 a ton. The first load weighed 2,250 pounds, the second 2,375 pounds, and the third 3,650 pounds.

21. Ice was sold at the rate of 10¢ for a cake weighing 25 pounds. Find the cost of 500 pounds at this rate.

WORKING IN A FACTORY

In the Alexander Hamilton School the pupils are working problems about wages paid to men in factories. Tom, whose father works in the sash-and-door factory, reported the wages in this shop as follows:

Carpenters	$.935 an hour
Glaziers	1.03 an hour
Hardwood finishers	1.068 an hour

1. During the month of October the factory ran 9 hours a day. Find the total wages which a man in each of these three trades received during this month. (26 days.)

2. How much more than a glazier did a hardwood finisher receive a day? than a carpenter?

3. Mr. Jones, a carpenter, worked 46 hours one week. What was the amount of his pay check?

4. Mr. Smith, a glazier, worked full time one week. What was his wage that week?

5. Mr. Olson, a carpenter, received $39.27 as his weekly wage. How many hours did he work that week?

6. Mr. Wilson, a glazier, received $53.56 as his weekly wage. How many working hours was he idle during the week?

7. The men in this factory receive $1\frac{1}{2}$ hours pay for each hour they work overtime. What is the hourly wage for each of the classes of workmen for overtime work?

8. During one week Preston Olson, a carpenter, worked 54 hours time, and 3 hours overtime. What wages did he receive that week?

9. If the workmen in this factory work 9 hours a day, 309 days in the year, what will be the yearly earnings of men in each of these trades?

WEATHER PROBLEMS

1. On Monday at noon the thermometer registered 17° above zero. The next morning at 6:00 o'clock it registered 11° below zero. How many degrees did it fall in 18 hours? Draw a picture of a thermometer to show this.

2. During a flood a river rose 8.45 feet above high-water mark, and then in one day, because of the breaking of the dam and the levee, it fell to a point 1.25 feet below low-water mark. How many feet did it fall in one day? Draw a diagram to help you to find the answer.

3. At a Weather Bureau station the following was the record of rainfall during a week: Sunday, 1.2 inches; Monday, .5 inch; Tuesday, .03 inch; Wednesday, .003 inch; Thursday, .7 inch; Friday, 1.5 inches; Saturday, .8 inch. Find the total rainfall and the average daily rainfall for the week.

4. The ice on a pond was 5.45 inches thick on Monday evening, and 6.15 inches thick on Tuesday morning. How much thicker than on Monday evening was it on Tuesday morning?

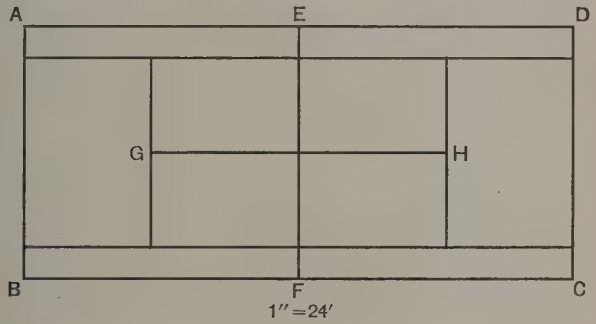
5. The following were the temperature records at noon for one week: Sunday, 24.5°; Monday, 18.1°; Tuesday, 4.5°; Wednesday, 4°; Thursday, 5.4°; Friday, 32.5°; Saturday, 34°. What was the average noon temperature for the week?

6. How many degrees above the week's average was the temperature on Friday? How many degrees below the week's average was it on Wednesday?

***7.** Keep a record of the temperature outdoors at intervals of an hour from 8 A.M. to 8 P.M. Find the average temperature for the day.

DRAWING TO SCALE

This drawing represents a tennis court drawn to a scale of 24 feet to the inch. Use a ruler to find the answers to the questions below the diagram.



1. What is the width of the tennis court?

2. What is the length of the court? Look up the dimensions of a tennis court in a rule book on tennis. Were your measurements accurate?

3. Find the length from G to H.

4. Draw a tennis court to the scale of 1 inch to 12 feet.

5. What is the area of a tennis court expressed in square feet?

*6. Draw a plan of your playground to a scale.

*7. If there is a tennis court near your school, measure it to see if its dimensions are correct.

*8. What are the correct dimensions of a baseball diamond? Draw a plan of a baseball diamond to scale. Show the pitcher's box.

*9. What are the correct dimensions of a basket-ball court?

*10. Find the plan of a house drawn to scale.

SHORT TESTS IN MIXED PROCESSES

Test I

1. 984
639
887
597
749
157

2. Subtract
89.6
27.58

3. $8.64 \times .07$

4. $5 \div 2\frac{1}{7} =$

5. $6\frac{1}{2} - 5\frac{2}{3} =$

6. $98 \times 4\frac{1}{4}$

7. $3.7\overline{)7.437}$

Test II

1. 566
434
265
423
528
346

2. Subtract
38.764
37.9

3. $.329 \times .48$

4. $2\frac{1}{2} \times 3\frac{1}{5} \times \frac{1}{8} =$

5. $.046\overline{)24}$

6. $46 \times 5\frac{3}{5}$

7. $92.2\overline{)37.802}$

Test III

1. Add 37.6, 48.95, 28.007, 75, and 126.748.
2. Subtract 46.307 from 148.2.
3. Subtract $9\frac{1}{3}$ from $18\frac{1}{6}$.
4. Add $4\frac{1}{4}$, $5\frac{1}{5}$, and $7\frac{7}{8}$.
5. $78.5 \times 1.6 =$
6. $32\overline{).16}$
7. Divide 35.28 by 8.4.

Test IV

1. Multiply: $3 \times 1\frac{1}{4} \times \frac{10}{21}$.
2. Add 4.8, 9.6, 18, .347, and 342.1.
3. Subtract 7.28 from 48.
4. Add $5\frac{1}{2}$, $6\frac{7}{8}$, and $5\frac{3}{4}$.
5. Multiply 6.48 by 2.7.
6. $.39\overline{)36.27}$
7. $1.8\overline{).497}$

EVERYDAY USES OF DECIMALS

1. A gallon of water weighs 8.36 pounds. A gallon of milk weighs 8.622 pounds. Find the difference in their weights.

2. How much more than 5 gallons of water do 5 gallons of milk weigh?

3. At the time of a flood in Arkansas, the water rose from 12.4 feet to 16.3 feet between 8 A.M. and 1 P.M. What was the average rise an hour?

4. After the water had reached its greatest height it was 27.7 feet deep. How much did it rise after 1 P.M.?

5. After the water began to fall, it fell 1.6 feet in 5 hours. How much did it fall an hour on the average?

6. A runner ran 100 yards in 10.5 seconds. How many yards a second was this?

7. Find the area of a farm 1.4 miles long and 1.5 miles wide. How many acres does it contain?

8. Here are the height and weight measurements of four children taken a year apart. Find the gains in weight and height for each child.

	Height (in.)			Weight (lb.)		
	First	Second	Gain	First	Second	Gain
Harry	57.2	58.6	?	85.4	91.2	?
Helen	56.7	56.9	?	78.3	82.3	?
Mary	59.8	61.0	?	98.5	106.7	?
Jack	46.0	47.9	?	60.1	71.0	?

9. An airplane flew at the rate of 124.6 miles an hour. How far will it fly in 1.7 hours at that rate?

10. The total rainfall in some parts of Arizona is about 10 inches a year. What is the average monthly rainfall?

REVIEW OF IMPORTANT POINTS

This exercise will help you to review the important points that you have learned about decimals.

1. Tell how to place the decimal points in adding decimals; in subtracting decimals.

2. How many decimal places must be pointed off in the product of .14 and 2.3? State the rule for such examples.

3. Write the examples below in the proper form to show how the decimal points should be shifted:

$3.2\overline{)17.5}$ $\quad$ $4.16\overline{)5.476}$ $\quad$ $.65\overline{)13}$ $\quad$ $3.42\overline{)273.6}$

4. Find the quotients of the examples in No. **3.**

5. Change $\frac{9}{15}$ to a decimal.

6. Find the product of .25 and 788 in two ways.

7. What is the correct quotient of $3\overline{).27}$? of $14\overline{).056}$?

FINDING DIFFICULTIES IN WORKING WITH DECIMALS

Some of the mistakes frequently made in working with decimals are given in the examples below. Explain what is incorrect in the work. Then work the examples correctly.

1.	**2.**	**3.**	**4.**
1.4	.06	.4	95.8
2.75	.05	.6	82.796
.08	.02	.5	13.100
2.97	.011	.15	

5. $8 - .5 = .3$ **6.** $.65 - .3 = .62$ **7.** $8 - .5 = .75$

8. $.2 \times .3 = .6$ **9.** $.2 \times .34 = .680$ **10.** $2 \times .12 = .024$

11. $.04 \times .6 = .0024$ **12.** $.05 \times 2 = 0.1$ **13.** $9.85 \div 5 = 197$

14. $4\overline{).16}$ $\quad$ **15.** $.25\overline{)7.5}$ $\quad$ **16.** $1.2\overline{)8.4}$ $\quad$ **17.** $75\overline{)60}$

OUT WEST

1. Mr. Larson lives on a ranch in a western state. The land he owns is in the form of a rectangle $1\frac{3}{4}$ miles long and $1\frac{1}{2}$ miles wide. How many square miles does his ranch contain?

2. Check your answer to problem **1** by dividing the area of his ranch in square miles by the length of the ranch.

3. How many acres of land are there on the ranch? (1 sq. mi. = 640 A.)

4. Draw a map of Mr. Larson's ranch to the scale of 2 inches = 1 mile. How long will your map be? how wide? What will be its area in square inches?

5. Mr. Larson's nearest railway station is 1,536 miles from Chicago. What will a railway ticket from the station to Chicago cost at 3.6¢ a mile? Check your answer by dividing the cost of the ticket by 3.6¢.

6. The price of a railway ticket to New York from this station is $90.72. The rate is 3.6¢ a mile. How many

miles is it from this station to New York? Check by multiplication.

7. The climate where Mr. Larson lives is dry and stimulating, warm in summer and cold in winter. One day last summer the thermometer stood at 82°. One day in winter it reached 38° below zero. What is the difference in degrees between these temperatures?

8. This western state has an area of 83,888 square miles and has an average of 5.85 people a square mile. What is the population of the state?

9. On a map of the United States the scale is 263 miles to the inch. A straight line from Mr. Larson's railroad station to Chicago is $5\frac{1}{4}$ inches long. How far is it in a straight line to Chicago? Prove your answer.

REVIEW OF DECIMALS

As a review of decimals, work the following examples. If you can do all of them quickly and correctly, you know how to work with decimals very well.

Copy the examples and find the answers:

1. $2.1 + 14.65 + 756.3 + .045 =$
2. $.7 + 147.8 + .004 + 5.47 =$
3. $.964 + 579.3 + 4.82 + 100.01 =$
4. $985.42 - 756.37 =$
5. $579.35 - 84.231 =$
6. $436.1 - 35.268 =$
7. $59.842 - 10.4 =$
8. $65.32 - .001 =$
9. $8.7 \times 6.4 =$
10. $.75 \times .4 =$
11. $6.41 \times .01 =$
12. $.5 \times .03 =$
13. $7{,}790 \div 8.2 =$
14. $76.704 \div 96 =$
15. $14.307 \div .19 =$
16. $36.2 \div .47 =$
17. $.4224 \div .012 =$
18. $.3756 \div 4 =$

19. Change to common fractions, or mixed numbers:
.9; .25; .075; $2.37\frac{1}{2}$; 1.4; .48; 3.8; 6.125

SPECIAL EXERCISE WITH HUNDREDTHS

How many of the following examples can you do correctly in 15 minutes?

I

1. .25 + .75 =
2. .96 − .07 =
3. 1. − .16 =
4. .24 × 75 =
5. .04 × 100 =
6. .07 × 400 =
7. .05 × 240 =
8. .03 × 160 =
9. .07 × 200 =
10. 1.04 × 300 =
11. Does $\frac{3}{4}$ equal .75, .075, 7.50, or 75?
12. Does $\frac{1}{2}$ equal .05, .005, 5, or .50?
13. Express $\frac{7}{10}$ as hundredths.
14. Subtract .65 from .8.
15. 1.25 × 400 =
16. .4 × .75 =
17. .04 × 1,000 =
18. Express .03 as a common fraction.
19. Express .17 as a common fraction.
20. 1.25 ÷ .25 =

II

Express $\frac{7}{8}$ as hundredths.

$$8\overline{)7.00} = .87\frac{1}{2}$$

To express $\frac{7}{8}$ as hundredths, change $\frac{7}{8}$ to a decimal, carrying the work to two places.

There is a remainder of 4 after the work has been carried to two places. $\frac{4}{8} = \frac{1}{2}$. Therefore $\frac{7}{8} = .87\frac{1}{2}$.

1. Express each of the following fractions as hundredths:
$\frac{5}{8}$; $\frac{3}{8}$; $\frac{5}{6}$; $\frac{1}{6}$; $\frac{2}{3}$; $\frac{1}{3}$; $\frac{7}{25}$; $\frac{1}{25}$; $\frac{18}{25}$

2. Express the following fractions as hundredths. Remember that .1 is equal to .10.
$\frac{3}{10}$; $\frac{7}{10}$; $\frac{1}{5}$; $\frac{2}{5}$; $\frac{4}{5}$; $\frac{1}{4}$; $\frac{3}{4}$; $\frac{7}{20}$; $\frac{17}{20}$

3. Express the following as common fractions:
.05; .08; .20; .12$\frac{1}{2}$; .25; .75; .375; .625; .4

4. Express the following as hundredths:
.4; 1.5; 6.2; .2$\frac{1}{2}$; .3$\frac{1}{2}$; .1; .375; .875

PROBLEMS ABOUT RAILROADS

3	9		VIA GRAFTON, W. VA., AND NEWARK, OHIO (*Eastern Time*)		12	528	4
Daily P.M.	Daily P.M.	Miles			Daily A.M.	Daily A.M.	Daily P.M.
5.50	4.45	0.0	Lv	New York, N. Y. (Penna. Sta.)	Ar	8.04	6.50	12.40
5.42	4.30	0.0	Lv	New York, N. Y. (Hudson Ter.)	Ar	8.04	6.50	12.41
5.45	4.33	1.0	Lv	Jersey City, N. J. (Exch. Pl.)	Ar	8.01	6.47	12.38
5.52	4.52	——	Lv	Newark (Park Place)	Ar	8.02	6.40	12.30
a6.21	5.16	12.0	Lv	Newark (Meeker Ave.)	Ar	n7.35	p6.18	n12.08
a6.54	——	34.1	Lv	Bound Brook, N. J.	Ar	n7.08	n5.47	n11.43
8.01	6.42	86.9	Lv	Wayne Jct., Pa.	Ar	6.01	4.23	10.39
8.20	7.03	94.7	Lv	Philadelphia	Ar	5.36	3.58	10.17
b8.38	7.22	106.6	Lv	Chester, Pa.	Ar	r5.17	——	9.57
8.56	7.40	119.7	Lv	Wilmington, Del.	Ar	4.58	3.18	9.40
——	——	131.9	Lv	Newark, Del.	Ar	——	——	9.23
10 20	9.03	189.1	Lv	Baltimore Md. (Mt. Royal)	Ar	——	1.35	8.12
10.25	9.08	190.6	Ar	Baltimore, Md. (Camden)	Lv	3.20	1.25	8.07
10.32	9.12	190.6	Lv	Baltimore, Md. (Camden)	Ar	3.13	1.20	8.03
11.27	10.00	227.4	Ar	Washington, D. C.	Lv	2.20	12.25	7.15

1. How many miles is it from Philadelphia to Washington by this railroad?

2. What is the fare between Philadelphia and Washington on this railroad at 3.6¢ a mile? Count a fraction of a mile as a mile.

3. What does a ticket from New York to Washington cost at 3.6¢ a mile?

4. How long does train No. 3, leaving New York at 5:50 P.M., take to make the trip to Washington? Express your answer in hours and minutes.

5. How long does it take train No. 9, leaving New York at 4:45 P.M., to make the trip from New York to Washington? Express your answer in hours.

6. What is the average speed an hour of train No. 9?

7. At Christmas time one year this railroad charged a fare and a half for the round trip.

a. How far is it from Newark, Delaware, to Washington?

b. What is the price of a one-way ticket between these cities at the regular price of 3.6¢ a mile?

c. What will the round trip cost at a fare and a half for the round trip?

8. Find the price of a ticket, at 3.6¢ a mile, from New York to each of the stations named on this time-table.

9. The railroads of the United States in a recent year had about 69,414 locomotives, 57,159 passenger cars, and 2,379,131 freight cars. They employed 1,751,324 persons, paying them wages amounting to $2,826,025,230 a year. Copy these numbers, telling what each represents; point them off correctly, and be able to read them.

10. The rails commonly used are 30 feet long and weigh about 90 pounds to the yard. Find the weight of a rail.

11. First estimate, and then find as accurately as you can, how many rails are used in building one mile of railroad.

12. Nearly all American railways are of standard gauge; that is, the width between rails is 4 feet, $8\frac{1}{2}$ inches. Express this distance in inches.

13. An average railroad locomotive burns 243 pounds of coal for every mile it runs. How many tons of coal will an engine burn on a 200-mile run?

14. The coal cars used on a certain railroad hold 45.6 tons. How many tons of coal will a train consisting of 55 coal cars contain?

15. The Alexander Hamilton High School uses, on the average, 1,140 tons of coal a year. How many car loads of coal of 45.6 tons each will the Board of Education purchase annually for this building? What will the coal cost at $3.75 a ton?

16. A certain coal mine produced 726,850 tons of soft coal a year.

a. Counting 50 tons to the car load, how many car loads of coal did the mine produce in a year?

b. How many trains of 45 cars each will this make?

17. The Twentieth Century Limited on the New York Central Railway has an average speed of 50 miles an hour in going from New York to Chicago. The distance between New York and Chicago is 908.2 miles. Find the time in hours and minutes that it takes this train to make this run.

18. At 3.6¢ a mile, find the cost of a ticket from Chicago to New York.

19. Coal cars hold, on the average, 50.1 tons of bituminous coal. What is the weight of the coal in a train of 48 cars?

20. A stock car on a western railroad carries about 9.8 tons of hogs, or 10.2 tons of sheep. A train is made up of 24 stock cars loaded with hogs, and 22 cars loaded with sheep. How many tons of freight is this train carrying?

DIAGNOSTIC TEST NO. III

This exercise will test your ability to work different kinds of examples. If you have difficulty with any of the examples, practice on others like them.

1. $3\frac{1}{2} + 4\frac{1}{3} + 2\frac{1}{5} =$

2. $28 - 16\frac{1}{8} =$

3. Find the cost of $4\frac{3}{4}$ pounds of meat at \$.45 a pound.

4. $5 \div 8\frac{1}{3} =$

5. Find the sum of 28.5, 3.07, .6, and .175.

6. Subtract 3.856 from 7.

7. Find the product of 2.5 and 4.03.

8. Divide 62.5 by 2.5.

9. 9 = ? of 27. Express as a fraction, and as a decimal.

10. 1.5 lb. = ? oz.

11. *a.* $100 \times 6.5 =$ *b.* $10 \times .06 =$

12. *a.* $856 \div 100 =$ *b.* $74.3 \div 10 =$

13. *a.* $15 \times ? = 360$ *b.* $8\frac{1}{3} = 5 \times ?$

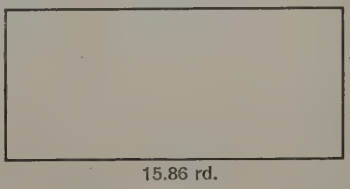
14. $160 = 2\frac{1}{2} \times ?$

15. $84 = .6 \times ?$

16. If the area of a field is 180 square rods and its length is 25 rods, what is its width?

17. Find the perimeter of the field at the right.

18. Find the area of the field.



19. $.03 \times 245 =$

20. $.25 \times 240 =$

21. Express $\frac{4}{5}$ as a decimal. Express .125 as a common fraction.

22. Find the volume of a box 8.2 inches long, 6.3 inches wide, and 8 inches deep.

PRACTICE TESTS IN FRACTIONS

You should be able to find the answers to the examples in each of the following sets in less than 10 minutes.

Addition Practice Test II

1. $\frac{1}{8}$ + $\frac{5}{8}$ =
2. $5\frac{5}{6}$ + $2\frac{5}{6}$ =
3. $\frac{1}{3}$ + $\frac{1}{5}$ + $\frac{3}{10}$ =
4. $\frac{4}{5}$ + $\frac{2}{5}$ =
5. $\frac{1}{4}$ + $\frac{1}{2}$ + $\frac{1}{4}$ =
6. $4\frac{1}{5}$ + $1\frac{1}{4}$ =
7. 4 + $1\frac{2}{3}$ =
8. $3\frac{2}{3}$ + $2\frac{1}{6}$ =
9. $5\frac{1}{12}$ + $\frac{5}{6}$ =
10. $3\frac{1}{5}$ + $\frac{1}{5}$ =
11. $7\frac{3}{4}$ + $3\frac{1}{2}$ =
12. $\frac{5}{6} + \frac{3}{4} + \frac{5}{12} =$

Subtraction Practice Test II

1. $\frac{5}{6}$ − $\frac{1}{6}$ =
2. $7\frac{1}{8}$ − $\frac{5}{8}$ =
3. $2\frac{3}{8}$ − $\frac{1}{3}$ =
4. $5\frac{1}{4}$ − 3 =
5. $\frac{1}{2}$ − $\frac{1}{4}$ =
6. $3\frac{5}{8}$ − $1\frac{1}{6}$ =
7. $7\frac{5}{8}$ − $2\frac{3}{8}$ =
8. $4\frac{1}{3}$ − $\frac{1}{12}$ =
9. $3\frac{7}{8}$ − $1\frac{1}{12}$ =
10. $3 - 1\frac{2}{3} =$
11. $2\frac{2}{3}$ − $\frac{5}{6}$ =
12. $7\frac{1}{5}$ − $6\frac{3}{4}$ =

Multiplication Practice Test II

1. $\frac{1}{9}$ of $3 =$
2. $\frac{5}{9} \times \frac{3}{7} =$
3. $\frac{1}{4} \times 2\frac{1}{2} =$
4. $3\frac{3}{4} \times 3\frac{1}{3} =$
5. $2 \times \frac{4}{9} =$
6. $6 \times 3\frac{3}{4} =$
7. $\frac{2}{3} \times 4\frac{3}{4} \times \frac{2}{3} =$
8. $\frac{36\frac{5}{6}}{12}$
9. $8 \times \frac{1}{6} =$
10. $3\frac{1}{6} \times 4 =$
11. $6\frac{4}{5} \times \frac{3}{7} =$
12. $\frac{18}{4\frac{1}{2}}$

Division Practice Test II

1. $5 \div \frac{2}{3} =$	**5.** $\frac{1}{7} \div \frac{1}{6} =$	**9.** $\frac{5}{6} \div \frac{3}{10} =$
2. $2\frac{5}{8} \div \frac{3}{4} =$	**6.** $5\frac{5}{9} \div 5 =$	**10.** $1\frac{1}{5} \div 4 =$
3. $\frac{1}{3} \div 1\frac{1}{2} =$	**7.** $8 \div 14 =$	**11.** $5 \div 2\frac{3}{4} =$
4. $1\frac{1}{3} \div 3\frac{1}{3} =$	**8.** $6\frac{1}{3} \div 2 =$	**12.** $9 \div 1\frac{1}{8} =$

Practice these examples until you can do them all correctly in the time allowed.

PRACTICE IN DECIMALS

1. Express as decimals: $\frac{1}{2}$, $\frac{2}{7}$, $\frac{3}{5}$, $\frac{5}{8}$.

2. Express as common fractions: .6, .25, .30, .875.

3. Find the sum of 8.24, 14, .6259, 18.6, .005.

4. Subtract:

$26 - .26$ $\quad$ $26 - 2.6$ $\quad$ $26 - .026$

5. Multiply:

5×1.6 $\quad$ $.5 \times 16$ $\quad$ $.5 \times .16$

6. Divide:

$7\overline{)3.57}$ $\quad$ $7\overline{)35.7}$ $\quad$ $7\overline{).357}$

PRACTICE TEST IN DECIMALS II

You should be able to find the answers to the following examples in less than 10 minutes.

1. Express as decimals: $\frac{1}{5}$, $\frac{1}{8}$, $\frac{9}{20}$, $\frac{7}{25}$.

2. Express as common fractions: .05, .15, .1, .375.

3. Find the sum of 9.25, 15, 6.375, 1.5, and .002.

4. Subtract: (*a*) .04 from .14; (*b*) 6.15 from 91.2.

5. Multiply: (*a*) $4 \times .76$; (*b*) 24×1.2; (*c*) 1.25×7.5.

6. Divide: (*a*) $4\overline{)3.28}$; (*b*) $1.25\overline{)7.5}$; (*c*) $24\overline{)1.2}$.

Practice these examples until you can work all of them correctly in the time allowed.

PROBLEM SCALE III

1. Jack earns 18 cents an hour working in his father's garden. What does he earn in 9 hours?

2. Alice had \$5.40. She spent \$1.25 for a book. How much did she have left?

3. Jack's chickens eat $12\frac{1}{2}$ pounds of grain each week. How much do they eat in 20 weeks?

Standards	
Excellent	9 or 10 correct
Good	7 or 8 correct
Fair	5 or 6 correct
Unsatisfactory	0 to 4 correct

4. Apples are on sale at 4 pounds for 25 cents. What do 12 pounds cost?

5. A play yard is $9\frac{1}{3}$ feet by $10\frac{1}{2}$ feet. How many square feet is its area?

6. Mr. Smith bought 145 bushels of potatoes for \$1.25 a bushel. He sold them at \$1.49 a bushel. How much did he make?

7. Mrs. Smith uses $\frac{3}{4}$ pound of butter a day. How long will $7\frac{1}{2}$ pounds last?

8. A government report states that in a recent flood the water rose $16\frac{1}{2}$ inches in 3 hours. Find the average rise an hour.

9. A charitable lady divided 6 pies equally among 3 families for a Thanksgiving dinner. In one family there were eight people. What part of a pie would each of these persons receive if the pies were divided into equal parts?

10. Harry had an order for $2\frac{1}{2}$ bushels of cherries. In the morning he picked $1\frac{1}{4}$ bushels and in the afternoon $1\frac{3}{4}$ bushels. How many bushels more than he needed did he pick?

D

CHAPTER IV

SOME USES OF PER CENT

When the sixth-grade class of the Roosevelt School began the study of percentage, Miss Porter asked the pupils to tell her any uses of the words *per cent* that they knew or had heard outside of school. Here are some of the uses that were given. Can you add any others?

1. John said, "My per cent of attendance on my last report card was 98."

2. Mary said, "Last term 85 per cent of the pupils in our class were promoted."

3. Jane said, "The principal reported that 83 per cent of our class are members of the Junior Red Cross."

4. Arthur told the class that the bank paid 4 per cent interest on his savings account.

5. Two of the pupils told about a sale at which clothing was sold at a reduction of 15 per cent.

6. Henry showed that per cent was usually written with the sign %.

7. One of the boys said that per cent was used in finding the standings of teams in the school league.

8. Some of the pupils read paper clippings which contained something about per cent.

Miss Porter told the pupils that *per cent* is the word that business men use instead of the word hundredths.

MEANING OF PER CENT

Per cent means *hundredths*. $\frac{67}{100}$ as a decimal is .67; .67 is also written 67 per cent or 67%. Any fraction or decimal that is expressed as hundredths can be written as a per cent. The sign used for per cent is %.

25% means .25	25% of 40 means .25 × 40
8% means .08	8% of 50 means .08 × 50
4.5% means .045	4.5% of 64 means .045 × 64
$12\frac{1}{2}$% means .$12\frac{1}{2}$	$12\frac{1}{2}$% of 36 means .$12\frac{1}{2}$ × 36
20% means .20 or .2	20% of 50 means .20 × 50
100% means 1.00	100% of 50 means 1.00 × 50

100 per cent of anything means the whole of it.

The work you are to do in percentage will be easy because you will make use of much of what you have learned about decimals. Always remember that *per cent* means *hundredths*.

1. Change these per cents to hundredths:
28%; 65%; 8%; 7%; 15%; 20%; 40%; 50%; 125%; 200%

2. Is 5% equal to .5, 500, or .05?

3. Is 45% equal to .45, 450, or 4.5?

4. Is 60% equal to 60, .60, or .06?

5. Is 75% equal to .75, 7.5, or 7,500?

6. Is 150% equal to .15, 1.50, or 150?

7. How much less than 100 per cent of a number is 48 per cent of it?

Think: 100% − 48% = —%.

8. Sixty per cent of a class were boys. What per cent were girls?

Think: 100% − 60% = —%.

9. On a spelling test Alice's mark was 90%. What per cent of the words did she spell incorrectly?

FINDING A PER CENT OF A NUMBER

1. The school nurse reported that 20 per cent of the pupils in a class of 40 were absent because of illness. How many were absent?

20% of 40 = .20 × 40 = 8	Think: 20% of 40 = ? Express 20% as a decimal, .20. Then multiply 40 by .20.

2. Find 6% of $100.

Find:

3. 35% of 80 **6.** 20% of 90 **9.** 12% of 800

4. 75% of 64 **7.** 8% of 75 **10.** 95% of 640

5. 50% of 40 **8.** 4% of 125 **11.** 40% of 425

12. The school baseball team won 75% of the 16 games played. How many games were won?

13. Forty-five per cent of the pupils in the school were girls. There were 800 pupils in all. How many were girls?

14. What is 16% of 48?

15. 18% of 150 = .18 × 150 **21.** .75 × 64 = —% of 64

16. 22% of 160 = — × 160 **22.** .25 × 60 = —% of 60

17. 45% of 280 = — × 280 **23.** .58 × 65 = —% of 65

18. 6% of 250 = — × 250 **24.** .08 × 75 = —% of 75

19. 9% of 275 = — × 275 **25.** .04 × 175 = —% of 175

20. 150% of 80 = — × 80 **26.** .07 × 874 = —% of 874

27. Express the following as decimals:

6% 8% 20% 125% 140% 200%

28. Express the following as per cents:

.16 .25 .05 .08 1.28 1.6 1.10

PER CENTS AND HUNDREDTHS

During the month of November the sixth-grade class in the Adams School studied 100 words in spelling. Here is the record of part of the class:

	Correctly Spelled		Correctly Spelled
Harry	87 words	Richard	97 words
Jane	92 words	Mary	100 words
Arthur	67 words	Julia	93 words

1. Of the 100 words, how many words did Harry spell correctly? How many hundredths of the words was this? What per cent of the words did he spell correctly?

Think: 87 is what part of 100?
87 is $\frac{87}{100}$ of 100.
$\frac{87}{100} = .87 = 87$ per cent $= 87\%$.

2. How many hundredths of the words did Jane spell correctly? What per cent of the words did she spell correctly?

3. Who spelled 67% of the words correctly? 93%?

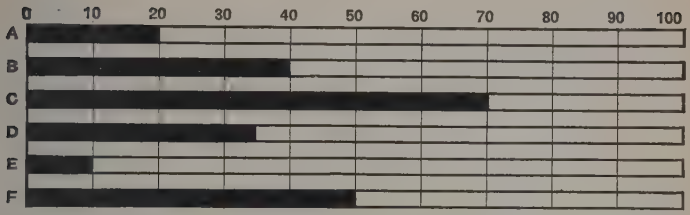
4. Who spelled 100% of the words correctly?

5. On an arithmetic test of 25 examples, Mary worked 18 correctly. What was the ratio of the number correct to the number in the test?

Think: The ratio of 18 to 25 $= 25\overline{)18.00} = .72$ hundredths $=$ 72%. .72 or 72 per cent is the part of the examples Mary worked correctly.

6. On the same test of 25 examples, Jane had 22 correct. How many hundredths did Jane have correct? What per cent did she have correct?

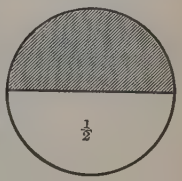
SHOWING PER CENTS BY GRAPHS



1. What per cent of each bar is shaded?

2. What per cent of each bar is not shaded?

3. Draw a figure showing four bars, one with 50% shaded, one with 40% shaded, one with 15% shaded, and one with 75% shaded.



A

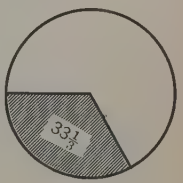
4. What per cent of circle *A* is shaded?

5. What per cent is not shaded?

6. What per cent of circle *B* is not shaded?

7. Draw a circle with 25% of it shaded.

8. Draw a circle with 75% of it shaded.



B

DIFFERENT WAYS OF EXPRESSING NUMBERS

You have learned that 25 per cent may be written in the decimal form as .25. It may also be written as the fraction, $\frac{25}{100}$, which, reduced to lowest terms, equals $\frac{1}{4}$.

$$25\% = .25 = \frac{25}{100} = \frac{1}{4}$$

$$75\% = .75 = \frac{?}{100} = ?$$

Express the following per cents in the three other forms given on page 125:

1. 15%	**4.** 60%	**7.** 50%	**10.** 35%
2. 20%	**5.** 80%	**8.** 70%	**11.** 5%
3. 40%	**6.** 30%	**9.** 36%	**12.** 10%

Using Fractions for Per Cent

You will often find it easier to use the fractional form instead of the decimal form. Study the following cases:

What is 25% of 488? This example can be worked in two ways:

The Decimal Form	The Fraction Form
488 .25 24 40 97 6 122.00	$.25 = \frac{1}{4}$ $\frac{1}{\cancel{4}} \times \frac{\overset{122}{\cancel{488}}}{\cancel{\ }} = 122$

Which of these two ways do you prefer? Why?

Learn the following fractional forms of the most commonly used per cents. When you know them perfectly, you can save much time in working problems.

$25\% = \frac{1}{4}$	$33\frac{1}{3}\% = \frac{1}{3}$	$40\% = \frac{2}{5}$
$75\% = \frac{3}{4}$	$66\frac{2}{3}\% = \frac{2}{3}$	$60\% = \frac{3}{5}$
$50\% = \frac{1}{2}$	$37\frac{1}{2}\% = \frac{3}{8}$	$80\% = \frac{4}{5}$
$20\% = \frac{1}{5}$	$12\frac{1}{2}\% = \frac{1}{8}$	$87\frac{1}{2}\% = \frac{7}{8}$

1. Give 25%, then 50%, then 75%, then 40% of the following: 100; 80; 40; 36; 96; 25; 75.

2. Give $12\frac{1}{2}\%$, $33\frac{1}{3}\%$, $66\frac{2}{3}\%$, 20%, and 60% of these numbers: 24; 48; 240; 60; 90; 360.

REDUCTIONS AT SALES

1. A dry goods store advertised a sale with reductions of 20%, 25%, $33\frac{1}{3}$%, and 50% on different kinds of cloth. What fractions have the same value as these per cents?

2. Find the reduction on a piece of cloth, regularly priced at \$8, marked 25% off.

3. What was the sale price of this piece of cloth?

4. Find the reduction and the sale price on a dress, regularly priced at \$40, and marked 20% off.

Find the missing numbers:

	Regular Price	Per Cent Reduction	Reduction	Sale Price
5.	\$100	20	\$20	\$80
6.	\$200	25	?	?
7.	\$300	$33\frac{1}{3}$	?	?
8.	\$2.50	50	?	?
9.	\$4.00	20	?	?
10.	\$7.50	$33\frac{1}{3}$	?	?
11.	\$9.00	25	?	?
12.	\$8.69	50	?	?
13.	\$15.00	20	?	?
14.	\$8.73	$33\frac{1}{3}$	?	?
15.	\$9.45	20	?	?

16. Which would be cheaper and how much, a \$40 dress sold at a reduction of $33\frac{1}{3}$ per cent, or a \$35 dress sold at a reduction of $\frac{1}{4}$ from the regular price?

17. Arthur bought a bicycle, listed in a catalogue at \$36, at a reduction of 5 per cent. What did the bicycle cost him?

18. Find the reduction on 6 yards of 40-cent material, on sale at a reduction of 25%.

PRACTICE WITH PER CENT

Practice with these per cents until you can find the answers in each set in less than 1 minute.

Set I

	a	*b*	*c*
1.	10% of 60 =	30% of 80 =	60% of 70 =
2.	20% of 80 =	40% of 80 =	80% of 100 =
3.	10% of 40 =	50% of 80 =	75% of 100 =

Set II

1.	6% of 100 =	7% of 600 =	9% of 200 =
2.	8% of 200 =	5% of 400 =	8% of 600 =
3.	9% of 400 =	3% of 600 =	4% of 500 =

Set III

1.	$12\frac{1}{2}$% of 80 =	$33\frac{1}{3}$% of 10 =	25% of 80 =
2.	$37\frac{1}{2}$% of 80 =	$33\frac{1}{3}$% of 90 =	25% of 400 =
3.	$62\frac{1}{2}$% of 80 =	$66\frac{2}{3}$% of 90 =	25% of 100 =

Set IV

1.	75% of 200 =	20% of 60 =	75% of 300 =
2.	40% of 125 =	25% of 160 =	$33\frac{1}{3}$% of 120 =
3.	60% of 250 =	20% of 40 =	$66\frac{2}{3}$% of 300 =

Set V

1.	25% of 400 =	$12\frac{1}{2}$% of 400 =	8% of 125 =
2.	6% of 150 =	8% of 250 =	75% of 400 =
3.	$37\frac{1}{2}$% of 800 =	$37\frac{1}{2}$% of 1,200 =	4% of 125 =

Set VI

1.	25% of \$100 =	6% of \$150 =	$33\frac{1}{3}$% of \$960 =
2.	75% of \$200 =	50% of \$186 =	$37\frac{1}{2}$% of \$800 =
3.	10% of \$12.50 =	$12\frac{1}{2}$% of \$160 =	60% of \$500 =

A LESSON ON PER CENT

A principal placed this notice on the bulletin-board. It shows the number of pupils in each grade and the per cent who joined the Junior Red Cross.

GRADE	NO. IN GRADE	PER CENT WHO JOINED
1.....	50	54%
2.....	40	60%
3.....	40	65%
4.....	45	80%
5.....	35	60%
6.....	36	75%

The sixth-grade class used the bulletin for a lesson in arithmetic. Below are some of the problems that were made from the table.

1. What class had the largest per cent of memberships?
2. What per cent in each class did not join?
3. How many pupils in each class became members?
4. How many did not become members? Find this in two ways.
5. What was the average per cent who joined the Junior Red Cross?
6. How many per cent less of third-grade children than of fourth-grade children joined the Junior Red Cross?

ABOUT PER CENTS

1. Does per cent mean the same as hundredths?
2. .25 may be written —— per cent.
3. 15% may be written $\frac{15}{100}$.
4. Are $\frac{17}{100}$ and .17 equal in value?
5. 5% in its decimal form is ——.
6. The fractional form of 9% is ——.
7. What part of a number is 100 per cent of it?
8. .4 equals —— per cent.

BATTING AVERAGES

A school baseball team kept a record of the hits made by the players. They wished to select the best batter according to the method used in the big leagues. One of the boys asked a player how this was done. He was told to divide the number of hits by the number of times at bat, and to carry the work to three places. He illustrated by taking Ruth's record for 1922.

	Games	At Bat	Hits	Average
Ruth	152	520	205	.394

205 (hits) ÷ 520 (at bat) = .394. Show the work. Why is the answer a decimal?

1. Here is a record of a school baseball team according to the batting order. Find the batting average of each player. Which player had the best average?

Name	Position	Games	A. B.	Hits	Average
John	s s	14	70	19	?
Harry	2 b	14	72	18	?
Sam	l f	12	62	21	?
George	c f	14	76	34	?
Jack	r f	14	71	7	?
Keith	1 b	13	68	19	?
Dick	3 b	14	69	8	?
Leo	c	12	59	15	?
Carl	p	14	77	25	?

***2.** Look up batting averages in the baseball rule book or in daily newspapers. Check some of them.

LEARNING TO USE PER CENTS FOR DECIMALS

You have learned that per cent means hundredths. .75 = 75 per cent = 75%.

1. Read .125 as a per cent.

.125 can be written as 12.5 hundredths or 12.5%.

.125 can also be written as .12$\frac{1}{2}$ or 12$\frac{1}{2}$%.

In the number 12.5%, $\frac{1}{2}$% is expressed as .5%.

2. Read .375 as a per cent.

3. Express the following as per cents:

.625; .875; .0625; .3125; .0475; .086.

4. Write the fractions in the following per cents as decimals:

12$\frac{1}{2}$%; 37$\frac{1}{2}$%; 16$\frac{1}{4}$%; 7$\frac{3}{4}$%; 9$\frac{4}{5}$%; 4$\frac{7}{8}$%.

5. Copy this table and write the missing numbers. Express the decimals as hundredths.

Fractions	Decimals	Per Cent	Decimals	Fractions	Per Cent	Per Cent	Decimals	Fractions
$\frac{1}{2}$			.4			5%		
$\frac{1}{4}$			.8			8%		
$\frac{1}{8}$			.12			4%		
$\frac{1}{3}$			.15			10%		
$\frac{2}{5}$			1 25			16%		
$\frac{3}{8}$			.45			20%		
$\frac{3}{4}$			1.05			1%		
$\frac{2}{3}$			.35			24%		
$\frac{1}{25}$			.01			75%		
$\frac{1}{20}$			.15			90%		
$\frac{1}{10}$			4.5			95%		
$\frac{1}{100}$			.005			100%		
$\frac{1}{300}$			.001			105%		
$\frac{1}{200}$			.002			150%		
$\frac{1}{500}$			1.01			200%		

FINDING WHAT PER CENT ONE NUMBER IS OF ANOTHER

1. On a stormy day only 25 children out of a class of 40 were at school. What per cent of the children were present?

$.62\frac{1}{2} = 62\frac{1}{2}\%$ $40\overline{)25.00}$ 240 100 80 20 $\frac{20}{40} = \frac{1}{2}$	To find what per cent were present, find how many hundredths 25 is of 40. $\frac{25}{40}$ = ? hundredths. Carry the quotient to two places as shown at the left. $.62\frac{1}{2}$ of the children or $62\frac{1}{2}\%$ were present. $62\frac{1}{2}\%$ may also be written 62.5%.

2. On another day 30 of the children were present. What was the per cent of attendance?

3. The teacher of another class placed the following table on the blackboard and asked the children to figure the per cent of attendance for each day and the per cent for the entire week. Complete the table.

	Number Enrolled	Number Present	Per Cent Present
Monday	40	40	?
Tuesday	40	36	?
Wednesday	40	35	?
Thursday	40	37	?
Friday	40	39	?
Total	?	?	?

4. On what day was the per cent of attendance the largest?

*D **5.** Make a table like this for your own class for one week.

SCHOOL MARKS

1. On a spelling test of 50 words, Harry misspelled 10. What was his per cent of accuracy?

2. On an arithmetic test of 12 examples, Harry had 10 correct, and John had 8. How much higher than John's was Harry's per cent of accuracy?

3. On a spelling test of 25 words, what per cent should be subtracted for each word missed? on a test of 20 words?

4. On a test of 20 words, Mary spelled 60% correctly. How many words did she misspell?

5. On a reading test of 15 questions, Mary had 20% incorrect. How many questions did she have correct?

6. The passing mark in a geography class was 75%. On a test of 45 questions Harry missed 10. Did he pass the test?

7. Children with a per cent of attendance of less than 90 were asked to report to the principal's office. Which of the following children would have to report?

	Days Present	Days Absent	Total Days	Per Cent of Absence
Mary	49	21	?	?
Harry	65	5	?	?
Kate	69	1	?	?
Peter	58	12	?	?
John	63	7	?	?

8. What per cent of the answers to the first 7 problems did you have correct?

***9.** On your next test find what per cent you have correct.

***10.** Find your own per cent of attendance for last month and the per cent of attendance for the class.

PRACTICE IN FINDING WHAT PER CENT ONE NUMBER IS OF ANOTHER

1. 5 = —% of 10
2. 6 = —% of 12
3. 9 = —% of 18
4. 2 = —% of 8
5. 4 = —% of 20
6. 5 = —% of 25
7. 9 = —% of 27
8. 6 = —% of 9
9. 8 = —% of 12
10. 9 = —% of 15
11. 8 = —% of 64
12. 12 = —% of 15
13. 18 = —% of 18
14. 16 = —% of 160
15. $\frac{1}{4}$ = —% of $\frac{1}{2}$
16. .4 = —% of 2.8
17. 9 = —% of 100
18. 6 = —% of 300
19. 5 = —% of 30
20. $\frac{1}{2}$ = —% of 25
21. 100 = —% of 240
22. 250 = —% of 800
23. 300 = —% of 1,000
24. 750 = —% of 475
25. 600 = —% of 480
26. $3\frac{1}{2}$ = —% of 5

FRACTIONS, DECIMALS, AND PER CENTS

Complete these examples in the same way that the first one is worked. Do the work without a pencil.

1. 4 is $\frac{1}{4}$, .25, 25% of 16.
2. 3 is —, —, —— of 12.
3. 2 is —, —, —— of 10.
4. 6 is —, —, —— of 24.
5. 8 is —, —, —— of 16.
6. 5 is —, —, —— of 15.
7. 6 is —, —, —— of 8.
8. 9 is —, —, —— of 12.
9. 2 is —, —, —— of 16.
10. 6 is —, —, —— of 16.
11. 20 is —, —, —— of 100.
12. 16 is —, —, —— of 20.

Complete these examples in the same way. Use pencil. Express the decimal form as hundredths.

13. 18 is —, —, —— of 54.
14. 24 is —, —, —— of 60.
15. 60 is —, —, —— of 96.
16. 30 is —, —, —— of 144.
17. 39 is —, —, —— of 117.
18. 22 is —, —, —— of 121.
19. 114 is —, —, —— of 152.
20. 75 is —, —, —— of 125.

TESTING SEEDS

1. Harry planted 20 kernels from an ear of his prize corn, and 18 of them sprouted. What per cent of the kernels sprouted?

2. He tested another ear by planting 25 kernels. Of these, 21 sprouted. What per cent of the kernels of corn sprouted? What per cent did not?

3. How many more kernels a hundred sprouted on the second ear than on the first?

4. To find how much better than ordinary corn his prize corn was, he tested three ears of ordinary corn by planting 25 kernels from each ear in separate boxes. In one box 10 sprouted, in another 7, and in the other 6. What per cent of the kernels in each box sprouted? What per cent of the seeds in the three boxes sprouted?

5. What was the difference in per cents between the prize corn in problem **1** and the ordinary corn?

6. A class studying plants tested some cabbage seeds by planting 12 of them in a box. Of these, 9 sprouted. What per cent sprouted? What per cent did not sprout?

7. If you were testing two kinds of seeds and one tested 75% and the other 90%, which would you use? Why?

*8. Test some seeds to see what per cent of them will sprout.

*9. How may a farmer select good seeds for the next year's planting?

PER CENTS LARGER THAN 100

Sometimes per cents larger than 100% are used.

1. Mary's baby brother weighed 6 pounds when he was born. At the end of 6 months, he weighed 14 pounds. His weight at the end of 6 months was what per cent of his birth weight? What per cent of 6 pounds is 14 pounds?

14 = ?% of 6.

To find what per cent 14 lb. is of 6 lb., divide 14 by 6. $14 \div 6 = 2\frac{1}{3}$. When reduced to hundredths, $2\frac{1}{3}$ equals $2.33\frac{1}{3}$ or $233\frac{1}{3}\%$.

2. Fifteen pounds is what per cent of 10 pounds? of 7.5 pounds?

3. The children in the picture at the top of this page were weighed and their heights recorded at birth. Now

they are again being weighed and measured by the school nurse. Their records appear in the following table. Find the per cent gain in weight and height for each child.

Child	Height		Per Cent Gain	Weight		Per Cent Gain
	at Birth	Today		at Birth	Today	
Susan....	21	41		8	36	
Max.....	20	38		$7\frac{1}{2}$	32	
Betty....	19	39		$6\frac{3}{4}$	33	
Sam....	$22\frac{1}{2}$	40		$7\frac{1}{4}$	35	

VALUES OF PER CENTS

I. One hundred per cent of anything is equal to the whole of it. For example: 100% of 35 = 1.00 × 35 = 35.

II. Less than 100 per cent of a number is equal to less than the number. Show how this is true.

III. More than 100 per cent of a number is more than the number. Show how this is true.

Which of the following per cents of a number are more than the number? Which are less than the number? In each case gave the reason.

1. 84% **4.** $33\frac{1}{3}$% **7.** 140% **10.** 6.25%
2. 62% **5.** 75% **8.** $100\frac{1}{2}$% **11.** 283%
3. 184% **6.** 63.4% **9.** $5\frac{1}{4}$% **12.** 428%

Use fractional forms (page 126) in working the following examples:

13. Give 50% of the following: 8; 16; 34; 50; 24; 96; 500.

14. Give 25% of 16; 28; 4; 12; 36; 64; 108.

15. Give 125% of each number in examples **13** and **14**; give 200% of each number.

WEIGHING SCHOOL CHILDREN

In Jefferson School the nurse weighs the children to find if they are at normal weight. If they are more than 10 per cent below normal weight for their age and height, she reports this to the parents. This is the way she finds the per cent that a child is underweight.

1. John weighs 96 pounds. The normal weight for his age and height is 100 pounds. What per cent is he underweight?

> Think: 100 lb. − 96 lb. = 4 lb. underweight.
> Per cents of underweight and overweight are always figured on the normal weight.
> Think: 4 lb. is ?% of 100 lb. 4 ÷ 100 = .04 or 4%.

2. Harry weighs 108 pounds and his normal weight is 100 pounds. How much is Harry overweight? What per cent is this of his normal weight?

3. Here are the weights of six of Harry's classmates and their normal weights. Find what per cent each one is of normal weight, and what per cent each is over- or underweight. Mark per cents of overweight +, and per cents of underweight −. Copy the table neatly.

	Weight	Normal Weight	Per Cent of Normal	Per Cent Over- or Underweight
Arthur	94 lb.	100 lb.	?	?
Kate	110 lb.	100 lb.	?	?
John	102 lb.	120 lb.	?	?
Peter	150 lb.	125 lb.	?	?
Mary	$137\frac{1}{2}$ lb.	125 lb.	?	?
James	105 lb.	125 lb.	?	?

4. Which children are more than 10 per cent underweight?

D ***5.** Are you underweight or overweight?

HOW MUCH YOU SHOULD WEIGH

This table will help you to tell whether you are under weight, over weight, or normal weight.

AGE IN YEARS

HEIGHT IN INCHES	BOYS					GIRLS				
	11	12	13	14	15	11	12	13	14	15
48	57	...	...	...	...	..	...	...	...	...
49	58	...	...	...	...	..	...	...	...	...
50	59	61	...	...	...	61	...	...	...	...
51	61	61	...	...	...	64	65	...	...	...
52	63	64	64	...	...	67	67	...	...	...
53	68	68	68	...	...	69	69	71	...	...
54	71	71	71	72	...	70	71	73	...	...
55	74	74	74	74	...	75	75	77	78	...
56	77	78	78	78	80	79	79	81	83	...
57	80	81	81	82	83	82	82	84	88	92
58	83	84	85	85	86	85	86	88	93	96
59	87	88	89	89	90	89	90	92	96	100
60	91	92	92	93	94	94	95	97	101	105
61	..	95	96	97	99	99	100	101	105	108
62	..	100	101	102	103	..	105	106	109	113
63	..	105	106	107	108	..	110	110	112	116
64	..	...	109	111	113	..	114	115	117	119
65	..	...	114	117	118	..	118	120	121	122

The table has two parts. In one part are given the standard weights of boys for ages 11 to 15. The other part gives the same information for girls. If you know your weight in pounds and your height in inches, you can find from the table how much you should weigh. The table tells you that a 12-year-old boy, 55 inches tall, should weigh 74 pounds. A 13-year-old girl, 56 inches tall, should weigh 81 pounds.

1. Find from the table whether you are over weight, normal, or under weight for your age and height. Find the per cent of normal weight you are above or below the normal.

The following chart contains the names of ten pupils in a sixth-grade class, their age, height, and weight. Find the

difference between each child's weight and the amount he should weigh. Then find the per cent of normal weight each child is above or below the normal.

	Age	Height	Weight	Normal Weight	Amount Above or Below Normal	Per Cent Above or Below Normal
2. Arthur	11	54	62			
3. Alice	12	56	83			
4. Boyd	14	61	104			
5. James	13	59	96			
6. Julia	12	53	76			
7. John	15	64	140			
8. Patricia	13	53	71			
9. Prudence	12	61	112			
10. Samuel	11	58	80			
11. Sarah	13	58	80			

12. Some medical authorities say that any child 15 per cent or more under weight is below the margin of safety. Which of these children are more than 15 per cent under weight?

13. Jack's birthday is in November. The June after his twelfth birthday he weighed 74 pounds and was 58 inches tall. His father and mother sent him to a summer camp for ten weeks. When he returned, he weighed 84 pounds and was 59 inches tall.

a. What per cent was he under weight in June?

b. Was his normal weight at the end of the summer the same as at the beginning of the summer? Explain.

c. Was he under weight or over weight at the end of the summer? How much?

d. What per cent of normal was he over weight or under weight at the end of the summer?

e. How much nearer normal was he at the end of summer than at the beginning?

PRACTICE WITH PER CENTS

You have learned two of the main uses of per cent:

I. Finding a per cent of a number:

4% of 25 = .04 × 25 = 1.

II. Finding what per cent one number is of another: 1 is what per cent of 25?

1 ÷ 25 = .04 or 4%.

Find the answers to the following examples. If you need help, review the work in percentage that you have had up to this point.

1. What is 6% of 250?
2. Find what per cent 10 is of 40.
3. What per cent of 15 is 10?
4. What is 8% of 326?
5. What per cent of 64 is 48?
6. Find how much 15% of $3,000 is.
7. Find what per cent 36 is of 108.
8. Find 5% of 125.
9. Find 125% of 16.
10. What per cent of 175 is 35?
11. Find 200% of 15.
12. How much is 75% of 80?

Supply the missing numbers:

13. 3 = —% of 6
14. 6 = —% of 12
15. 7% of 100 = —
16. 6 = —% of 18
17. 7 = —% of 21
18. 8% of 50 = —
19. 25 = —% of 100
20. 9 = —% of 36
21. 4% of 250 = —
22. 12 = —% of 60
23. 20% of 60 = —
24. 20% of 16 = —
25. — = 6% of 30
26. 18 = —% of 36
27. 3% of 125 = —
28. 30 = —% of 75
29. 2 = —% of 100
30. 8 = —% of 6
31. $66\frac{2}{3}$% of 40 = —
32. 80 = —% of 40
33. 40 = —% of 32
34. 4 = —% of 40
35. 7% of 40 = —
36. 80% of 75 = —

USING ROUND NUMBERS

In using large numbers, when exact figures are not required, we drop figures of little importance and write 0's in their places. When we say that there are 117,000,000 people in the United States, we use 0's to the right of the millions because exact figures are not important.

1. What would be an easy way to read these numbers as round numbers?

10,147 65,743 11,475,964

2. In which of the following statements are we speaking in round numbers?

a. He earned a few hundred dollars.
b. The bank had deposits amounting to $498,763.21.
c. In the battle 10,000 men were killed and wounded.
d. On the *Leviathan*, there were 7,500 soldiers.
e. There were 995,000 people in Detroit in 1920.
f. The freight car contained 1,257 bushels of wheat.
g. Thousands of people were present.

REVIEW OF DECIMALS

Practice giving the answers to these examples until you can do the work easily:

1. $.4 + .5 + .2 =$
2. $9.1 - .8 =$
3. $.5 \times 6 =$
4. $.8 \div 4 =$
5. $1.2 + 2 =$
6. $4.2 - 1.2 =$
7. $.3 + .4 =$
8. $6 \times 1.2 =$
9. $4.5 \div 5 =$
10. $9.0 + .5 =$
11. $8.1 \div .9 =$
12. $3.2 \div .04 =$
13. $5.1 + .07 =$
14. $8.6 - .05 =$
15. $9 - .001 =$
16. $\$4.50 \div \$.09 =$
17. $\$7.20 \div \$.80 =$
18. $\$2.50 \div 50 =$
19. $\$4.80 \div 12 =$
20. $3.7 + 1.3 =$

A COMPLETION TEST

Study this exercise carefully. Be ready to give the correct answers either orally or in writing.

1. $\frac{3}{4}$ expressed as a decimal is ——.
2. .45 expressed as a common fraction is ——.
3. 25% expressed as a decimal is ——.
4. To find 8% of 64, multiply —— by ——.
5. To find what per cent 8 is of 64 —— 8 by ——.
6. 2 is —% of 4.
7. 50 is —% of 100.
8. 7% of \$200 is ——.
9. 8% of 75 is — × 75.
10. 25% of 200 is ——.
11. 30 is —% of 120.
12. 3.6 cents is \$ ——.
13. 125% of 40 is — × 40.
14. $33\frac{1}{3}$% equals the fraction —.
15. 174 is —% of 100.
16. $\frac{7}{8}$ is —%
17. $\frac{4}{5}$ is —%.
18. $\frac{19}{100}$ is —%.
19. 3 inches is —% of a foot.
20. .8 is —%.

PRACTICE WITH PER CENTS

Supply the missing numbers:

1. 125% of 20 = —
2. $33\frac{1}{3}$% of 27 = —
3. 6% of 100 = —
4. 5% of 20 = —
5. 25 = —% of 20
6. 8 = —% of 100
7. 150% of 20 = —
8. 40% of 50 = —
9. 12 = —% of 15
10. 48 = —% of 72
11. 35% of 180 = —
12. 46% of 320 = —
13. 52 = —% of 25
14. 16 = —% of 50
15. 63 = —% of 72
16. 45 = —% of 72
17. 115% of 480 = —
18. 25% of 320 = —
19. 9% of 48 = —
20. $3\frac{1}{2}$% of 500 = —
21. 60 = —% of 72
22. $4\frac{1}{2}$% of 200 = —

BOY SCOUTS AND THEIR TESTS

Jack, who is in the sixth grade, is a member of the Boy Scouts. He is training Tom, who is a "tenderfoot." Jack, who is a "second class scout," knows a great deal about scouting. Here are some of the things that he has told Tom:

1. A full boy scout troop consists of 32 boys. It is divided into four equal patrols. What part of a troop is a patrol? How many boys are there in a patrol if the troop is a full one?

2. The Boy Scouts of America was organized in 1910. How long ago was this?

3. In a scout camp there were 8 boy scout troops. Two of them had 32 boys each, 3 had 30 boys each, 2 had 28 boys each, and one had 24 boys. What was the total number of scouts in the camp? What was the average number of boys in a troop?

4. A second-class boy scout must be able to go a mile in 12 minutes at the scout's pace. How many feet a minute must a second-class boy scout go on the average? how many in a second? (1 mi. = 5,280 ft.)

5. A first-class boy scout is able to send by semaphore a message of 30 letters in a minute. At this rate how long would it take a boy scout to send by semaphore the letters in the first verse of "America"?

6. A boy scout must make a trip alone, or with one other boy scout, to a point at least 7 miles away, either walking or rowing a boat. Jack walked alone to a place $7\frac{3}{4}$ miles away from his home and returned over the same road. How many miles did he walk?

7. He started at 6 o'clock Saturday morning and returned at 4:15 P.M. How many hours was he away on his trip? how many minutes?

8. A scout must be able to judge distance, size, number, height, and weight within 25%. Jack was asked to estimate the height of a tree. He said 66 feet. The true height was 72 feet. Was Jack's estimate within 25% of the true height?

Think: What is 25% of 72 feet? Subtract this number from 72 feet. This number will be the lower limit. Add 25% of 72 feet to 72 feet. This number will be the upper limit. Any estimate between these two numbers will be counted satisfactory.

9. In judging the height of this tree another scout said 92 feet. Was his estimate counted satisfactory?

10. On his test with weight, Jack estimated the weight of an iron bar to be 25 pounds. The weight was 28.2 pounds. Was Jack within the 25% limit? What are the lowest and the highest estimates that will be accepted in this test?

11. Before Jack took his test on estimating distances, he and three other boys practiced estimating the distance between two trees. (The measured distance was 420 yards.)

Jack's estimate was	20%	above	the	true	distance	
Jim's	"	"	15%	below	"	"
Herb's	"	"	10%	"	"	"
Bill's	"	"	40%	above	"	"

What was each boy's estimate?

Suggestion: After finding 20% of 420 yards, add this number to 420 yards. In finding Jim's estimate, will you add or subtract?

12. On the test the boys were asked to estimate the distance to a large oak tree. Jack's estimate was 25 feet more than the true distance, which was 250 feet. What per cent more than the true distance was Jack's estimate?

Think: 25 feet is what per cent of 250.

13. On the same test Jim's estimate was 260 feet, Herb's 200 feet, and Bill's 255 feet. What per cent over or under the true distance did each boy estimate?

PRACTICE WITH PER CENTS

1. Express the following as per cents:

.5 .27 1.3 2.65 .12½ .379 .09

2. Express the following as decimals:

20% 15% 6% 120% 219% 37½% 8.5%

3. Express the following as common fractions:

50% 25% 10% 12½% 50% 75% 40%

4. Find the following:

6% of 125	37½% of 80	120% of 100
8% of 429	50% of 120	200% of 375

5. Find the missing numbers below:

40 = —% of 400 80 = —% of 40

16 = —% of 1,600 $6.75 = —% of $10.00

PRACTICE TESTS IN THE FUNDAMENTALS

You should be able to find the answers to each set of examples in the time allowed and check your work.

Addition Test (8 minutes, not including copying)

1.	2.	3.	4.	5.	6.
487	875	312	391	564	891
509	585	497	773	349	111
260	172	485	539	643	982
981	868	926	797	366	523
532	530	479	894	899	227
429	469	839	619	548	624

Subtraction Test (4 minutes, not including copying)

1.	3.	5.	7.	9.	11.
7,115	6,709	9,417	8,000	7,809	6,343
3,460	4,871	7,239	6,895	5,813	1,254

2.	4.	6.	8.	10.	12.
7,618	6,000	5,675	4,684	5,805	4,048
6,127	3,562	3,677	4,675	1,905	1,090

Multiplication Test (8 minutes, not including copying)

1.	3.	5.	7.	9.	11.
357	319	731	941	385	274
46	85	39	64	27	58

2.	4.	6.	8.	10.	12.
269	916	268	956	584	742
93	72	204	580	903	270

Division Test (8 minutes, not including copying)

1. $74\overline{)29{,}230}$ **3.** $28\overline{)7{,}532}$ **5.** $93\overline{)14{,}647}$ **7.** $56\overline{)41{,}260}$

2. $65\overline{)18{,}265}$ **4.** $47\overline{)33{,}088}$ **6.** $39\overline{)10{,}452}$ **8.** $87\overline{)52{,}026}$

Use these tests for special practice from time to time.

PRACTICE TESTS IN FRACTIONS

You should be able to find the answers to the examples in each of the following sets in less than 10 minutes.

Addition Practice Test III

1. $\frac{1}{2}$	**3.** 5	**5.** $3\frac{1}{2}$	**7.** $2\frac{1}{3}$	**9.** $\frac{3}{4}$	**11.** $\frac{2}{3}$
$\frac{1}{2}$	$\frac{1}{4}$	8	$7\frac{2}{3}$	$\frac{1}{6}$	$\frac{4}{5}$
				$\frac{1}{8}$	$\frac{7}{10}$
2. $\frac{1}{2}$	**4.** $\frac{1}{3}$	**6.** $1\frac{1}{4}$	**8.** $2\frac{2}{3}$	**10.** $6\frac{2}{3}$	**12.** $\frac{5}{12}$
$\frac{1}{4}$	$\frac{5}{6}$	$3\frac{7}{12}$	$7\frac{5}{6}$	$4\frac{3}{4}$	$1\frac{1}{3}$

Subtraction Practice Test III

1. $4\frac{4}{5}$	**3.** $7\frac{1}{8}$	**5.** $9 - \frac{1}{2} =$	**7.** 6	**9.** $4\frac{5}{6}$	**11.** $3\frac{5}{6}$
$\frac{1}{5}$	7		$5\frac{2}{3}$	$\frac{3}{8}$	$2\frac{3}{4}$
2. $10\frac{1}{3}$	**4.** $\frac{1}{2}$	**6.** $7\frac{1}{2}$	**8.** $3\frac{1}{4}$	**10.** $4\frac{1}{4}$	**12.** $7\frac{1}{2}$
$3\frac{2}{3}$	$\frac{1}{6}$	$4\frac{2}{4}$	$\frac{11}{12}$	$\frac{5}{6}$	$7\frac{1}{3}$

Multiplication Practice Test III

1. $\frac{2}{5} \times 2 =$	**5.** $3 \times \frac{1}{3} =$	**9.** $\frac{1}{4}$ of $\frac{1}{6} =$
2. $\frac{5}{8} \times \frac{16}{25} \times \frac{1}{2} =$	**6.** $2 \times 4\frac{1}{5} =$	**10.** $3\frac{1}{6} \times 4 =$
3. $\frac{1}{2}$ of $1\frac{1}{5} =$	**7.** $3\frac{1}{3} \times \frac{2}{9} =$	**11.** $3\frac{2}{7} \times 2\frac{2}{3} =$
4. 18	**8.** $17\frac{1}{6}$	**12.** $3\frac{1}{5} \times \frac{3}{8} \times \frac{8}{9} =$
$15\frac{3}{4}$	5	

Division Practice Test III

1. $12 \div \frac{4}{5} =$	**5.** $\frac{1}{9} \div \frac{1}{3} =$	**9.** $1\frac{1}{4} \div \frac{1}{3} =$
2. $9 \div 8 =$	**6.** $\frac{4}{5} \div 6 =$	**10.** $5\frac{2}{3} \div 5 =$
3. $\frac{3}{8} \div 1\frac{2}{3} =$	**7.** $2 \div 2\frac{1}{2} =$	**11.** $5 \div 2\frac{1}{2} =$
4. $2\frac{3}{8} \div 2\frac{3}{8} =$	**8.** $1\frac{1}{4} \div 3 =$	**12.** $3\frac{1}{3} \div 6\frac{2}{3} =$

Practice these sets of examples until you can do them all correctly in the time allowed.

PRACTICE TEST IN DECIMALS III

You should be able to find the answers to the following examples in less than 10 minutes.

1. Express as decimals: $\frac{3}{4}$, $\frac{1}{3}$, $\frac{5}{6}$, $\frac{17}{20}$, $\frac{49}{50}$.
2. Express as common fractions: .07, .5, .675, $.33\frac{1}{3}$.
3. Find the sum of the following: 4.62, 75, .125, and .97.
4. Subtract: (*a*) .275 from .9; (*b*) 4.7 from 78.53.
5. Multiply (*a*) $.6 \times 20$; (*b*) $8.04 \times .03$; (*c*) 200×8.4.
6. Divide: (*a*) $3\overline{)7.47}$; (*b*) $.3\overline{)18.63}$; (*c*) $.33\overline{)87}$.

DIAGNOSTIC TEST NO. IV

If you have difficulty with any of the examples, practice others similar to them:

1. $1\frac{7}{8} \times 9\frac{5}{6} \times 2\frac{3}{4} =$
2. $16\frac{1}{8} - \frac{3}{4} =$
3. Multiply $1\frac{7}{8}$ by $3\frac{1}{5}$.
4. Divide $16\frac{2}{3}$ by 5.
5. Find the sum of 7.25, 1.375, 20, and .003.
6. Subtract 12.263 from 125.74.
7. Find the product of 2.56 and 1.93.
8. Divide 3967.5 by .075.
9. Express $\frac{7}{8}$ as a decimal and as a per cent.
10. 12 = ? of 60. Express as a fraction and as a per cent.
11. Express the following as decimals:
    30% 5% 125% 6% 15% 40%
12. Express as per cents.
    .26 .13 .1 .08 1.116 .6
13. Find 8% of \$2.50; \$175; \$48.00.
14. What per cent of 200 is 60? 40? 8? 100?
15. 15% of \$1.75 = ?
16. 125% of \$200 = ?
17. 30 = — % of 40
18. 60 = — % of 50

PROBLEM SCALE IV

1. Jack had a box that weighed 12 pounds when empty. After he filled it with potatoes, the box weighed 72 pounds. What did the potatoes in the box weigh?

Standards	
Excellent	9 or 10 correct
Good	7 or 8 correct
Fair	5 or 6 correct
Unsatisfactory	0 to 4 correct

2. Helen has \$5. Mary has \$2.25. How much more than Mary has Helen?

3. An automobile travels 14.5 miles for each gallon of gasoline used. How many miles does it travel if 48 gallons are used?

4. Harry's father travels in his automobile about 30 miles an hour. How long does it take him to go 45 miles?

5. Mrs. Smith bought a rug 12.3 feet by 10.5 feet. How many square feet is the area of the rug?

6. One month the Smith family used 16.2 K. W. H. of electricity. The cost of the electricity was 11.5 cents a K. W. H. Find the cost of the electricity.

7. If $\frac{3}{4}$ yard of bunting is needed for a school pennant, how many pennants can be made from $7\frac{1}{2}$ yards of bunting?

8. Mr. Jackson raised 59.4 bushels of potatoes on a field that contained 2.25 acres. Find the average number of bushels of potatoes an acre.

9. One morning Harry dug $7\frac{1}{2}$ bushels of potatoes. At noon he sold $3\frac{1}{4}$ bushels to a neighbor. In the afternoon he dug $4\frac{1}{2}$ bushels. How many bushels of potatoes did he then have?

10. The average number of bushels of wheat an acre in the United States is 14.5. On a 10-acre field, Mr. Smith raised 136 bushels of wheat. How much less than the average an acre was this?

CHAPTER V

SOME USES OF MEASUREMENTS

Miss Andrews asked the members of her arithmetic class to tell how they made use of different kinds of measurements.

1. Harry said, "I measured my young brother's height. He is 3 feet, $6\frac{1}{2}$ inches tall." How many inches is that?

2. Mary said, "I measured the distance around a handkerchief to find the length of lace needed to make a border." What is an easy way to find the distance around a square?

3. Kate's father hauled a load of wheat that weighed 1,800 pounds. Kate said that this load was equal to 30 bushels. Was Kate correct? (60 lb. wheat = 1 bu.)

4. Jane told about an automobile trip of 120.6 miles. Eight and one-half gallons of gasoline were used. How many miles was that to the gallon?

5. Arthur said, "My father's orchard is 165 feet by 330 feet." How many acres does it contain? (1 A. = 43,560 sq. ft.)

6. Jean said, "I rode on my bicycle to the park, a distance of $4\frac{1}{2}$ miles. I left school at 3:15 P.M. and reached the park at 3:45 P.M." At this rate, how many miles did she ride in an hour?

7. Howard told the class that his father had drawn a plan of a garage to the scale of 1 inch to 4 feet. What did Howard mean?

8. Alice said, "We have a thermometer on our gas oven for measuring the temperature of the oven." Explain.

WHAT MUST YOU KNOW?

In each of the following problems there is something which you must know before you can answer the problem. Tell what you must know in each problem and then solve it.

1. How many ounces does a can of fruit marked "1 lb. 4 oz." weigh?

2. The greatest speed at which an automobile has ever traveled is about 207 miles an hour. How many miles is this a minute?

3. Harry's brother, Jack, won the 880-yard run at the college track meet. What fraction of a mile is 880 yards?

4. The children collected 12 pecks of potatoes for the Thanksgiving boxes. How many bushels was this?

5. Mr. Smith owns a farm that is the shape of a square. It is 80 rods on a side. Is the distance around the farm more than a mile?

6. Alice was 4 feet $8\frac{1}{2}$ inches tall. How many inches shorter than Henry was she if Henry was $60\frac{1}{2}$ inches tall?

7. Mrs. Andrews wished to buy linoleum for the floor of the kitchen. The kitchen was 12 feet by 15 feet. Find the cost of linoleum at $1.20 a square yard.

8. Mr. Jackson hauled a load of wheat, weighing 1,800 pounds, to market. How many bushels were there in the load?

9. A gallon of water weighs about $8\frac{1}{3}$ pounds. Find the weight of a pint.

10. Harry had $\frac{1}{2}$ bushel of tomatoes to sell. He put the tomatoes into boxes, each of which held about 4 quarts. How many boxes did he fill?

11. How much more or less than an acre is a farm 100 rods long and 60 rods wide?

ADDING DENOMINATE NUMBERS

Numbers like 10 quarts, 3 ounces, and 10 miles, are called *denominate numbers* because they are named. Denominate numbers can be added, subtracted, multiplied, and divided.

1. Mary practiced her piano lesson for 1 hour 15 minutes in the morning and 1 hour 25 minutes in the afternoon. How long did she practice in all? In this problem you must add 1 hour 15 minutes and 1 hour 25 minutes. Such numbers are called *compound denominate numbers.*

1 hr. 15 min. 1 hr. 25 min. 2 hr. 40 min.	Write minutes under minutes and hours under hours as shown in the example. Add the minutes. Add the hours. Mary practiced 2 hr. 40 min.

2. Harry had a two-section fishing rod which was 3 feet $6\frac{1}{2}$ inches long. He bought another section 1 foot 8 inches long. How long was his fishing rod then?

3 ft. $6\frac{1}{2}$ in. 1 ft. 8 in. 4 ft. $14\frac{1}{2}$ in. = 5 ft. $2\frac{1}{2}$ in.	You can see that the sum of the inches is $14\frac{1}{2}$. This equals 1 ft. $2\frac{1}{2}$ in. Therefore 4 ft. $14\frac{1}{2}$ in. is written as 5 ft. $2\frac{1}{2}$ in.

Add the following denominate numbers:

3. 2 hr. 45 min.
3 hr. 10 min.

4. 2 lb. 10 oz.
4 lb. 0 oz.

5. 3 ft. 9 in.
2 ft. 6 in.

6. 3 ft. 8 in.
2 ft. $3\frac{1}{2}$ in.

7. 2 gal. 3 qt.
3 gal. $2\frac{1}{2}$ qt.

8. 1 T. 500 lb.
2 T. 1,500 lb.

9. 6 yd. $2\frac{1}{2}$ ft.
2 yd. $2\frac{1}{4}$ ft.

10. 1 qt. $1\frac{1}{2}$ pt.
2 qt. $\frac{1}{2}$ pt.

11. 4 mi. 220 yd.
2 mi. 1,500 yd.

SUBTRACTING DENOMINATE NUMBERS

1. John jumped over a parallel bar set at 4 feet $4\frac{1}{2}$ inches. The school record was 5 feet 3 inches. How much higher must John jump to reach the school record?

5 ft. 3 in.	You cannot subtract $4\frac{1}{2}$ in. from 3 in. Change
4 ft. 15 in.	5 ft. 3 in. to 4 ft. 15 in. First subtract the inches.
4 ft. $4\frac{1}{2}$ in.	15 in. $- 4\frac{1}{2}$ in. $= 10\frac{1}{2}$ in. There will be no feet.
$10\frac{1}{2}$ in.	John must jump $10\frac{1}{2}$ in. higher.

2. Mary can jump 5 feet 2 inches. How much higher than John can Mary jump?

3. A classroom was 21 feet 6 inches in length, and 14 feet 8 inches in width. How much greater than its width was its length?

4. In a certain week Mary practiced her piano lessons for 6 hours and 15 minutes. Grace practiced 4 hours and 35 minutes. How much longer than Grace did Mary practice?

Subtract the following:

5. 12 bu. 11 qt.
4 bu. 18 qt.

6. 25 ft. 5 in.
10 ft. 7 in.

7. 4 lb. 12 oz.
1 lb. 1 oz.

8. 5 hr. 18 min.
3 hr. 24 min.

9. 8 yd. $4\frac{1}{4}$ in.
4 yd. 9 in.

10. 7 lb.
2 lb. 7 oz.

11. Mary had a piece of ribbon 3 yards 8 inches in length. She cut off a piece 18 inches long. How long was the piece of ribbon that was left?

*12. Henry had gathered 1 bushel 4 quarts of butternuts. He gave a peck of them to his chum. How many quarts of butternuts did he then have?

MULTIPLICATION OF DENOMINATE NUMBERS

1. Mary's mother measured the windows for curtains. She found that for one room she would need 8 strips, each 8 feet 7 inches in length. How much cloth must she buy?

8 ft. 7 in. **8** **4 8** **64** **68 ft. 8 in. of cloth are needed.**	8×7 in. $= 56$ in. $= 4$ ft. 8 in. Write 4 ft. 8 in. as shown in the example. Multiply 8 ft. by 8. Write 64 as shown in the example. Add to get the amount of cloth needed.

2. In another room she needed 7 strips, each 8 feet 9 inches in length. How much cloth was needed for this room?

3. Find the weight of a box of 24 cans of peaches if each can weighs 1 pound 3 ounces. How do you change ounces to pounds?

4. An automobile travels a mile in 1 minute 35 seconds. At that rate, how long would it take to go 20 miles?

Find the products:

5. 8 ft. $5\frac{1}{2}$ in. × 7

6. 2 hr. 14 min. × 6

7. 8 lb. 15 oz. × 9

8. 1 qt. $\frac{1}{2}$ pt. × 9

9. 2 gal. $2\frac{1}{2}$ qt. × 5

10. 3 bu. $2\frac{1}{2}$ pk. × 4

11. 1 lb. $8\frac{1}{2}$ oz. × 6

12. 5 ft. 7 in. × 6

13. 3 yd. 2 ft. × 3

14. Find the total length of 6 boards each 10 feet $4\frac{1}{2}$ inches long.

ALBERT'S PRIZE POTATO PATCH

1. Albert raised potatoes as his boys' club project. Here is the record of his expenses and his time:

4 hr. plowing and harrowing at \$.60 an hr.	?
2 bu. of seed at \$.90 a bu.	?
$2\frac{1}{2}$ hr. planting at \$.25 an hr.	?
$3\frac{1}{2}$ hr. cultivating at \$.25 an hr.	?
$8\frac{1}{4}$ hr. digging at \$.25 an hr.	?
Fertilizer	\$2.00
Total cost	?

2. He raised 42 bushels on his patch. He sold 40 bushels of selected potatoes at \$1.20 a bushel, and the remainder at \$.50 a bushel. What did he receive for his potatoes?

3. Is it correct to count wages for himself as part of his expenses?

4. What was his profit?

5. How much time in all did he work in his potato patch?

***6.** His potato patch was 15 feet wide and 363 feet long. What fraction of an acre is this?

***7.** What would be the yield an acre at this rate?

8. Albert's chum, Arthur, raised 84 bushels of potatoes on a $\frac{7}{8}$-acre field. How many bushels did he raise an acre at this rate?

9. Arthur received \$105.00 for the 84 bushels of potatoes he raised. What did he receive a bushel? How much more than Albert received did Arthur receive a bushel?

FINDING COSTS

1. A piece of beefsteak purchased by Harry's mother weighed 1 pound 4 ounces. The price was 40¢ a pound. The butcher charged her 50¢ for the meat. To make sure this was the correct amount, she said, "One pound 4 ounces is $1\frac{1}{4}$ pound, since 4 ounces is $\frac{1}{4}$ pound; $1\frac{1}{4} \times \$.40 = \$.50$."

2. Find the cost of 1 pound 6 ounces of sirloin steak at 48¢ a pound.

Think: 1 pound 6 ounces = $1\frac{3}{8}$ pound.

Find the cost of the following:

3. 4 lb. 8 oz. of butter @ \$.48 lb.
4. 2 lb. 12 oz. of meat @ \$.44 lb.
5. 2 bu. 2 pk. potatoes @ \$1.20 bu.
6. 3 gal. 1 qt. of cider @ \$.60 gal.
7. 3 yd. 27 in. of cloth @ \$.24 yd.
8. 4 bu. 12 qt. of corn @ .84 bu.
9. 2 lb. 6 oz. pork chops @ \$.40 lb.
10. 14 oz. cheese @ \$.48 lb.
11. 5 lb. 3 oz. beefsteak @ \$.48 lb.
12. 9 oranges @ \$.56 doz.
13. 18 doughnuts @ \$.20 doz.
14. 21 in. ribbon @ \$.40 yd.
15. 7 qt. cider @ \$.30 gal.

FINDING AREAS

1. Find the area of a room 10 feet 6 inches long and 8 feet 4 inches wide.

Hint: change inches to feet and then multiply.

Find the areas of these rectangles:

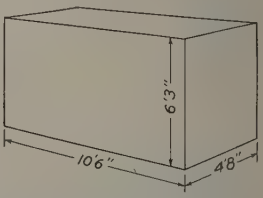
2. 10′ 6″ by 4′ 6″.
3. 8′ 7″ by 6′ 3″.
4. 4 yd. 2 ft. by 18 in.
5. 5 yd. 1 ft. by 1 yd. 2 ft.

CONTENTS OF A BOX

Harry wanted to find how many bushels there were in a large box that he had filled with potatoes.

a. He knew that a bushel equals $1\frac{1}{4}$ cubic feet. Explain what a cubic foot is.

b. He knew that the volume of a box is found by multiplying the length by the width by the height.



1. The dimensions of the box are shown in the drawing. How many cubic feet does the box contain?

$10' 6'' \times 4' 8'' \times 6' 3'' =$ the volume.

To find the volume, change the dimensions to feet, for example 10′ 6″ is $10\frac{1}{2}$ feet. Then find the volume in cubic feet. Divide the volume by $1\frac{1}{4}$ to find the number of bushels.

2. How many cubic inches are there in a box 8 inches long, 6 inches wide, and 1 foot 2 inches deep?

3. What is the cubic capacity of a room 15 feet long, 18 feet wide, and 10 feet high?

4. Find the volume of a box 4 feet 6 inches wide, 3 feet 4 inches long, and 6 feet 3 inches deep.

Find the volumes of the following:

5. A cake of ice, $18'' \times 14'' \times 15''$.

6. A box, $3' 6'' \times 2' 4'' \times 3' 1''$.

7. A tank, $40' \times 20' \times 5' 6''$.

8. A bin, $7' \times 8' 4'' \times 9'$.

*9. Measure a cereal package at home and find its volume or capacity.

DIVISION OF DENOMINATE NUMBERS

1. A railroad train traveled 5 miles in 7 minutes 10 seconds. What was the average time a mile?

1 min. 26 sec. 5)7 min. 10 sec.	7 min. ÷ 5 = 1 min., and 2 min. over. 2 min. = 120 sec. Add: 120 + 10 = 130 sec. 130 ÷ 5 = 26.

2. Is this method easier than changing 7 minutes 10 seconds to minutes and dividing by 5? Try it.

3. A farmer used 8 bushels 3 pecks of seed in planting a 3-acre field. How much an acre was this?

Divide each of the following:

4. 8 ft. 5 in. by 3.
5. 2 ft. 7 in. by 2.
6. 9 hr. 25 min. by 5.
7. 8 gal. 2 qt. by 6.
8. 6 t. 8 cwt. by 5.
9. 4 lb. 9 oz. by 6.

10. A baker used 7 pounds 8 ounces of flour to make 10 loaves of bread. How much flour a loaf was this?

11. Harry had three apple trees. From the first he picked 3 bushels 2 pecks, from the second 3 bushels 3 pecks, and from the third 4 bushels 3 pecks. What was the average yield a tree?

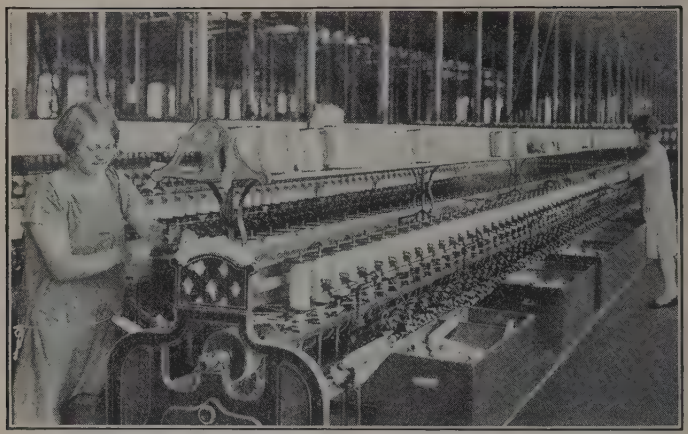
12. Below are given the heights of four eleven-year-old children:

Mary	5 ft. 1½ in.	Kate	4 ft. 9 in.
John	4 ft. 6 in.	Peter	4 ft. 11½ in.

What was their average height?

13. A carpenter cut a board 12 feet 6 inches long into 5 equal pieces. How long was each piece?

14. A passenger train traveled 40 miles in 1 hour 15 minutes. How many miles a minute was this?



SPINNING COTTON INTO THREAD AND CLOTH

Here are some interesting problems on manufacturing cotton into thread and cloth. When the cotton bales come to the factory, the compressed cotton in them is put through the "bale breaker," and then passed on to a machine called the "opener." One machine of this kind will open 8,000 pounds of cotton in 24 hours.

1. A bale of cotton weighs, on the average, 500 pounds. How many bales of the average weight will 8,000 pounds of cotton make?

2. How many bales will the "opener" open in 1 hour?

After being mixed, carded, and combed, the cotton is spun into thread. The size of thread which you see upon spools depends upon the number of yards required to make one pound. In the United States, the unit is 840 yards to the pound; that is, No. 1 cotton thread has 840

yards to the pound; No. 2 has 2 times 840 yards; No. 3 has 3 times 840 yards, and so on.

3. How many yards to the pound are there in each of the following sizes of cotton thread: No. 10? No. 36? No. 40? No. 50? No. 80?

4. Which will weigh more, 200 yards of No. 40 or 200 yards of No. 80?

5. Sea Island cotton will make a size as fine as No. 400. How many yards of this size of thread will make one pound?

6. A spool of No. 36 cotton thread has 200 yards upon it. How many such spools of thread will make one pound?

7. A pound of cotton is spun into No. 40 thread. The thread is then wound upon spools, 200 yards to each spool. How many spools are made?

8. Get some spools of thread. Notice the numbers of the thread, and also the number of yards on each. Find how many such spools can be made from 1 pound of cotton.

After the cotton is spun, the thread is woven into cloth. Any of the following may be produced from one pound of cotton: $1\frac{1}{2}$ yards of denim; 4 yards of sheeting; 7 yards of calico; 25 handkerchiefs.

9. How many yards of denim can be made from 9 pounds of cotton?

10. How many pounds of cotton are required to produce 84 yards of sheeting?

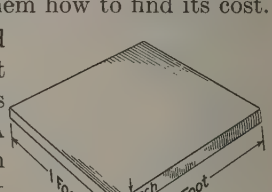
11. How many handkerchiefs can be made from a bale of cotton of the average weight? (See problem **1.**)

12. How many more yards of calico than of sheeting can be produced from 20 pounds of cotton?

HOW LUMBER IS MEASURED

John and Fred needed book shelves for their room. Their brother, Ben, drew a plan for them, helped to find how much lumber they needed, and showed them how to find its cost.

1. Lumber is usually measured by the *board foot.* A board foot of lumber is 1 foot long, 12 inches (1 foot) wide, and 1 inch thick. A board of ordinary lumber less than an inch thick is measured as if it were one inch thick.



To find the number of board feet in a piece of lumber, multiply the length in feet by the width in inches by the thickness in inches, and divide the result by 12.

2. Find the number of board feet in a board 8 feet long, 10 inches wide, and 2 inches thick (usually written 2″ x 10″ x 8′); in two boards of these dimensions.

Find the number of board feet in:

3. 3 boards, 3″ x 12″ x 9′

4. 6 boards, 2″ x 4″ x 12′

5. 7 boards, 1″ x 8″ x 10′

6. 2 boards, $\frac{7}{8}$″ x 6″ x 5′

HOW LUMBER IS SOLD

Lumber is usually sold at so much a 1,000, or M, feet. If a carpenter bought 200 feet of lumber at \$18 a M, he would find the cost as follows:

$$\frac{\cancel{200} \times \$18}{\cancel{1000}_{5}} = \frac{18}{5} = \$3.60$$

1. Find the cost of 400 feet of lumber at \$20 a M.

2. Find the cost of 458 feet at \$18.50 a M.

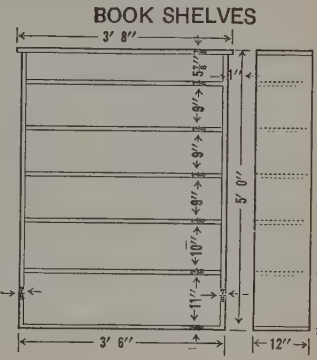
3. Find the cost of 3 boards, 2″ x 8″ x 10′, at \$16 a M.

4. Find the cost of 8 boards, $\frac{3}{4}$″ x 4″ x 12′, at \$24.50 a M.

D

THE COST OF LUMBER FOR THE BOOK SHELVES

1. Study the plan of the book shelves. The boys need for end pieces 2 boards, 5 feet long, 12 inches wide, and $\frac{7}{8}$ inch thick. How many board feet are there in these end pieces?



2. How many shelves are there? (Count the bottom board.) How long is each? how wide? how thick? How many board feet are there in the shelves?

3. How long is the top board? how wide? how thick? How many board feet are there in the top board?

4. The boys decided to board up the bookshelves at the back. For this they used boards 10 inches wide, $\frac{7}{8}$ inch thick. How many boards will they need?

5. How many board feet will there be in these boards?

6. How many board feet of lumber did the boys have to buy for their shelves?

7. What did the lumber cost at $15 a M.?

Find the cost of the following lumber:

8. 3 boards, $\frac{1}{2}$″ x 8″ x 12′ at $18 a M.

9. 7 boards, 2″ x 4″ x 8′ at $20 a M.

10. 20 planks, 2″ x 12″ x 12′ at $17.50 a M.

11. 16 planks, 4″ x 10″ x 10′ at $18.50 a M.

12. 40 boards, 2″ x 8″ x 12′ at $42 a M.

13. 75 boards, 1″ x 6″ x 14′ at $32 a M.

14. 80 boards, 1″ x 12″ x 10′ at $25 a M.

ACTING AS TRAFFIC POLICE

Arthur attends a large school in a city. A sign near the school said, "*Public School, Speed Limit 12 Miles an Hour.*" Arthur's class was asked to find whether or not cars passing the school were obeying the law. These are some of the problems Arthur's class solved:

1. If a car is traveling at the rate of 12 miles an hour, how many minutes will it take to go one mile?

2. How many seconds will it take to go a mile?

3. Arthur measured the street in front of the school grounds, and found that it was 660 feet from one end to the other. What part of a mile is this?

4. How many seconds will a car take to go this distance traveling at the rate of 12 miles an hour?

5. Arthur got a stop watch and timed cars going past the school. One took 25 seconds to go from one end of the grounds to the other. Was the driver of this car breaking the law?

6. Was a driver who took 40 seconds to go past the school grounds going faster than he should?

*7. At what rate in miles an hour were the cars mentioned in problems **5** and **6** going when they passed the school grounds?

A SPEED TEST IN FRACTIONS

Practice this exercise until you can give the answers to each set correctly in less than one and one-half minutes.

Set I

	a	*b*	*c*
1.	$\frac{1}{2}$ of 20 =	$\frac{1}{4}$ of 60 =	$\frac{1}{8}$ of 30 =
2.	$\frac{2}{3}$ of 45 =	$\frac{3}{4}$ of 40 =	$\frac{5}{8}$ of 40 =
3.	$\frac{1}{2}$ of 11 =	$\frac{2}{3}$ of 10 =	$\frac{3}{4}$ of 15 =

Set II

4.	6 = ? of 12	4 = ? of 6	9 = ? of 12
5.	8 = ? of 16	8 = ? of 24	12 = ? of 16
6.	9 = ? of 27	10 = ? of 15	15 = ? of 25

Set III

7.	5 = $\frac{1}{2}$ of ?	6 = $\frac{1}{3}$ of ?	8 = $\frac{2}{3}$ of ?
8.	4 = $\frac{1}{3}$ of ?	8 = $\frac{1}{5}$ of ?	16 = $\frac{4}{5}$ of ?
9.	9 = $\frac{1}{4}$ of ?	8 = $\frac{1}{2}$ of ?	10 = $\frac{2}{3}$ of ?

Set IV

10.	$\frac{1}{4}$ of 18 =	12 = ? of 18	36 = $\frac{2}{3}$ of ?
11.	8 = ? of 10	16 = $\frac{2}{3}$ of ?	$\frac{4}{5}$ of 60 =
12.	12 = $\frac{1}{2}$ of ?	$\frac{3}{4}$ of 20 =	16 = ? of 24

Set V

13.	$\frac{1}{2} + \frac{1}{4}$ =	$\frac{1}{4} + \frac{2}{3}$ =	$\frac{7}{10} - \frac{2}{10}$ =
14.	$\frac{1}{3} + \frac{5}{6}$ =	$\frac{3}{4} + \frac{4}{5}$ =	$\frac{3}{4} - \frac{1}{3}$ =
15.	$\frac{7}{8} + \frac{3}{4}$ =	$\frac{1}{2} + \frac{1}{10}$ =	$\frac{5}{6} - \frac{2}{3}$ =

PRACTICE WITH DECIMALS

Find the answers. How many of the examples can you work correctly without a pencil?

1. $.1 + .1 =$
2. $.3 - .1 =$
3. $5.2 - 4 =$
4. $.7 \times 7 =$
5. $7.2 \div .8 =$
6. $4.1 \times .2 =$
7. $84.7 \div 7 =$
8. $.01 + .9 =$
9. $6 \div .8 =$
10. $.06 \times 4 =$
11. $.001 \div .1 =$
12. $.017 - .004 =$
13. $7.735 \div .005 =$
14. $3.3 \times .3 =$
15. $4.003 + 2.4 =$
16. $5.6 \times .8 =$
17. $.04 \times 2.5 =$
18. $960 \div .8 =$
19. $1.4 + .7 =$
20. $5.8 + .3 =$
21. $5 - 1.64 =$
22. $7.8 \times .9 =$
23. $.006 \div .003 =$
24. $.004 + .072 =$
25. $6.53 - .12 =$
26. $6.4 \div 8 =$
27. $.005 \times 8 =$
28. $.07 + .06 =$
29. $4 - .003 =$
30. $5.36 \div .4 =$
31. $9.74 - 1.2 =$
32. $.468 \div 9 =$
33. $2.3 \times .04 =$
34. $5.1 + 6.02 =$
35. $6.5 \div .5 =$
36. $6.1 + 7.245 =$
37. $7.25 \div .05 =$
38. $.006 \times 71 =$
39. $15 + .17 =$
40. $8.127 \div 7 =$
41. $3.1 - .56 =$
42. $7.3 \times .08 =$
43. $9.258 - 3.249 =$
44. $4.52 + .001 =$
45. $75.36 - 74.05 =$
46. $8 \div .75 =$

47. Express the following as common fractions:

.5 .25 .75 .125 .2 .08

48. Change the following to decimals. Carry the work to three places:

$\frac{75}{86}$ $\frac{97}{108}$ $\frac{16}{47}$ $\frac{25}{33}$ $\frac{18}{19}$ $\frac{15}{16}$

A SHEEP RANCH

1. A sheep ranch in one of the western states had 37,725 sheep in the autumn. During the winter 1,509 died from exposure to the cold. How many of the sheep lived through the winter?

2. Ranchmen expect to lose 1 sheep in 25 during the winter. Suppose the owner of the sheep in the first problem had lost 1 in 25. How many would he have lost?

3. How many more or less than the number he actually lost would this have been?

4. What per cent is 1 in 25?

5. This ranch employed 26 ranchmen to care for the 37,725 sheep. How many sheep on the average was this to each man?

6. The wool of a Merino sheep is $2\frac{1}{2}$ inches long. The wool of a Lincoln sheep is 10 inches long.

a. How much longer than the wool of the Merino is the wool of the Lincoln sheep?

b. How many times as long?

7. A rancher clipped 304 sheep in one day. If the

average weight of a fleece is 8.7 pounds, how many pounds did he get from the sheep clipped that day?

8. He sold the wool at an average price of 42.5 cents a pound. How much did he receive for the wool he clipped that day?

9. One year 1,837,425 sheep were shorn in Montana. The average weight of the cleaned fleece was 8.6 pounds. How much wool was produced that year in Montana?

10. The wool taken from slaughtered sheep is called "pulled wool." About $\frac{1}{7}$ of all of the wool produced in the United States is "pulled wool." In a recent year 292,385,000 pounds of wool were produced in the United States. About how many pounds of this was pulled wool?

11. Australia and New Zealand produce about 30% of the world's supply of wool, the United States 10%, Argentina 9%, Russia 8%, Spain 6%, South Africa 6%, and Great Britain 4%. What per cent of the wool do all of the other nations of the world produce?

12. The raw wool clipped from 108 sheep weighed 3,096 pounds.

a. What was the average weight a fleece?

b. The cleaned wool weighed 30% of the weight of the raw wool. What did the cleaned wool weigh a fleece?

13. The owner of a sheep ranch in Wyoming found that the grease and dirt amounted to about 70% of the weight of raw wool. If raw wool from a sheep weighs 29 pounds, what will it weigh when cleaned?

14. One year Colorado produced 865,184 pounds of wool. If the average selling price a pound was \$.429, how much was received for the wool?

WAGONS OR MOTOR TRUCKS, WHICH?

1. Mr. Olson lived 25 miles from the railway. For years he used a wagon to take his wheat to the elevator. With a team and wagon it took him two days to make the trip, and he found his horses could make only two trips a week. How far did the team travel in the two trips?

2. His wagon held 35 bushels of wheat. How many bushels was he able to take to the elevator in a week?

3. At $1.30 a bushel, how much did he receive for all the wheat he could haul to the elevator in two trips?

4. Some years later, Mr. Olson bought a motor truck. He found he could take two truck loads of wheat to the elevator a day. How many miles would he travel in these trips in a day? in a week of six days?

5. He found the truck could take 70 bushels of wheat in a load. How many bushels could he haul to the elevator in a day? in a week of six days?

6. How much more than he could haul before in a week with his wagon could he haul in six days with his truck?

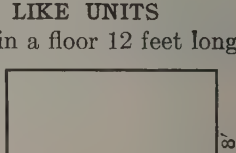
7. If he received $1.30 a bushel for the wheat, how much money would he receive for all of the wheat he could haul by truck to the elevator in one week? (See problem **5.**)

8. One year he harvested 1,470 bushels of wheat. How long would it take to haul this grain to the elevator by wagon? by truck?

9. How much less time than by team would it take to haul the 1,470 bushels of wheat by truck?

CHANGING DIMENSIONS TO LIKE UNITS

1. How many square feet are there in a floor 12 feet long and 8 feet wide?



In this case the dimensions are both given in the same units.

Notice the following problem.

2. What is the area of a floor 4 yards long and 8 feet wide?

Here the dimensions are not in the same unit, and one of them must be changed so that the unit of measure will be the same.

Change 4 yards to feet. The work would then be: $12 \times 8 = ?$ square feet, the area of the floor.

Or change 8 feet to yards. What would the work then be?

3. Find the perimeter of a farm $\frac{1}{2}$ mile long and 60 rods wide.

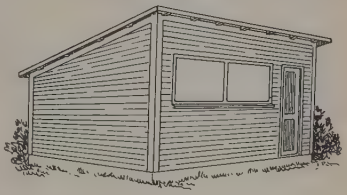
4. How many acres are there in a farm $\frac{3}{4}$ mile long and 160 rods wide?

Find the areas of the following rectangles:

	Length	Width		Length	Width
5.	25 ft.	12 yd.	**8.**	$\frac{1}{2}$ mi.	60 rd.
6.	18 yd.	40 ft.	**9.**	3 ft. 6 in.	2 ft. 4 in.
7.	100 yd.	10 rd.	**10.**	6 yd. 2 ft.	8 yd. $1\frac{1}{2}$ ft.

PAINTING A POULTRY HOUSE

Mr. Simpson's poultry house is to be painted. The door and the windows are all in the front of the building, and Mr. Simpson will paint this part himself. Jack is to put a coat of tar on the roof and one coat of paint on the two ends and the back of the poultry house. As he is to be paid by the square yard, his first problem is to measure the surface that he is to paint.



1. He first climbed to the roof. He saw at once that the surface of the roof was a rectangle. He found that it was 12 feet by 10 feet.

a. Draw a diagram of the roof to the scale of $\frac{1}{2}$ inch to 1 foot.

b. What is the area of the roof in square feet? in square yards?

2. Jack received 18¢ a square yard for putting the tar on the roof. What did he receive for this part of the job?

3. The back of the house is 12 feet by 7 feet.

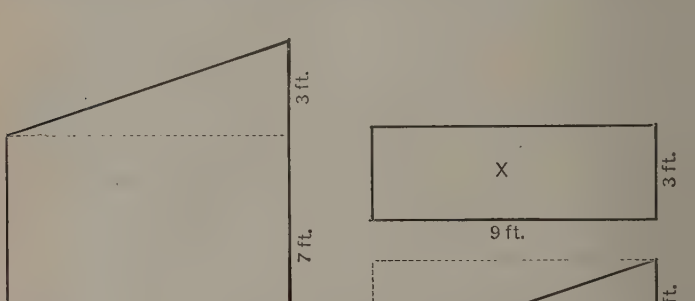
a. What is its area in square yards?

b. How much will Jack receive for painting the back of the house at 12¢ a square yard?

4. Jack drew a diagram of the ends of the chicken house like the diagram at the left on page 172. To what scale is it drawn?

5. Jack drew the dash line you see in the diagram. What shape is the surface below this line? What is its area in square feet? in square yards?

Jack did not know how to find the area of the triangle you see in the plan. His father helped him by drawing the diagram at the right:



6. What is the area of rectangle *X*?

7. Triangle *Y* is equal to the triangle in the plan of the end of the poultry house. You see that it is also equal to $\frac{1}{2}$ of the area of rectangle *X*. Its area must, therefore, be equal to $\frac{1}{2}$ of 9 x 3, or $13\frac{1}{2}$ square feet. Since 9 feet and 3 feet are the length and width of the rectangle, the area of the triangle is equal to $\frac{1}{2}$ of the product of the length and width of the rectangle.

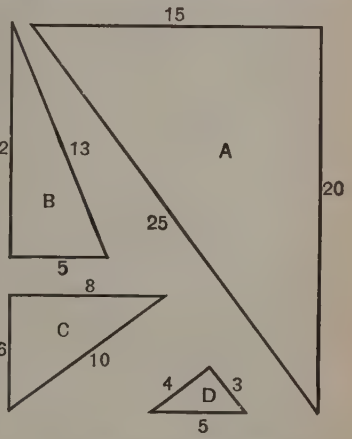
The height of a triangle is called its *altitude*. The side from which the altitude is measured is called its *base*. A triangle that is half of a rectangle is called a *right triangle*.

The area of a triangle is equal to $\frac{1}{2}$ the product of the base by the altitude.

8. Find how much Jack received for painting the poultry house at 12¢ a square yard.

FINDING AREAS OF RIGHT TRIANGLES

1. *A*, *B*, *C*, *D* are right triangles. The lengths of their sides are indicated. Find the base and altitude of each triangle. Then find its area.



2. Draw a right triangle with a base 7 inches and an altitude 3 inches. Find its area.

3. Draw a rectangle whose base is 5 inches and whose altitude is 4 inches. Find its area.

4. Draw a rectangle 3 inches long and 2 inches wide. What is its area? What is its perimeter?

5. Draw three right triangles. Measure their bases and altitudes and find their areas.

FINDING CUBIC CONTENTS

1. Find the number of cubic feet in a rectangular tank 8 feet by 7 feet by 11 feet.

2. Find the number of bushels that a wagon box 10 feet 6 inches long, 28 inches deep, and 42 inches wide will contain. A bushel equals about $1\frac{1}{4}$ cubic feet.

3. Find the capacity of the upper part of an ice box if the dimensions are $24\frac{1}{2}$ inches by $16\frac{1}{2}$ inches by 20 inches.

4. Find the capacity of the lower part of the ice box if the dimensions are $24\frac{1}{2}$ inches by $16\frac{1}{2}$ inches by 30 inches.

THE PROPER AMOUNT OF SPACE FOR HEALTHFUL LIVING

In schoolrooms 15 square feet of floor space a pupil and 180 cubic feet of air space a pupil are considered satisfactory.

1. In a schoolroom 23 feet wide and 32 feet long there are 40 pupils. Is there enough floor space for each pupil?

2. The height of the room is 12 feet. Is there enough air space for each pupil?

3. If the height of the room were $9\frac{1}{2}$ feet, would the number of cubic feet of air a pupil be up to the standard?

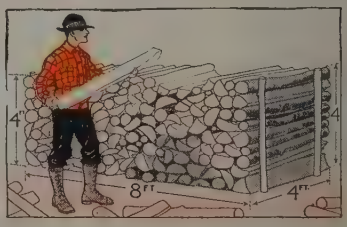
4. Find the number of square feet a pupil for your own classroom. Is it up to standard?

5. Find the number of cubic feet of air a pupil for your own classroom. Is it up to standard?

6. Find the same information for other rooms in your school.

MEASURING WOOD

1. Formerly when wood was plentiful, it was used a great deal. It was sold by the cord. A cord represents a pile of four-foot lengths, four feet high and eight feet long. How many cubic feet are there in a cord?



2. A good-sized schoolroom is 23 feet wide, 32 feet long, and 12 feet high. Would it hold 15 cords of wood?

3. How many cords would there be in a level-full truck whose capacity is 5 cubic yards?

FARM MEASURES

1. A bushel of shelled corn contains $1\frac{1}{4}$ cubic feet. How many bushels are there in a bin 6 feet long, 4 feet wide, and 2 feet 6 inches deep?

2. A bushel of potatoes contains $1\frac{1}{3}$ cubic feet. How many bushels are there in a bin 6 feet 6 inches long, 7 feet 4 inches wide, and 8 feet 3 inches deep?

3. How many gallons of water are there in a tank 6 feet 4 inches by 2 feet 6 inches by 3 feet 4 inches? A gallon = $\frac{1}{8}$ cubic foot.

4. A ton of tame hay contains 512 cubic feet. How many tons are there in a space 24 feet by 12 feet by 16 feet?

5. A ton of wild hay contains about 343 cubic feet. How many tons are there in a space 25 feet 6 inches by 18 feet 2 inches by 9 feet?

6. A cow produced, on the average, $3\frac{1}{2}$ gallons of milk a day. If a gallon weighs $8\frac{5}{8}$ pounds, how many pounds of milk does she produce a week?

7. Suppose you had a chicken yard 60 feet by 100 feet. What would it cost to fence the yard with chicken wire at $4\frac{1}{2}$¢ a foot?

8. A farmer, owning $64\frac{1}{2}$ acres, sold $15\frac{3}{4}$ acres and then bought 20 acres. How many acres did he then have?

9. Mr. Smith hauled a load of hay to town. The hay weighed 2,575 pounds. At $12 a ton what should Mr. Smith receive for the hay?

10. A dairy farmer sold to a creamery 5,624 pounds of milk, for which he was paid $1.75 a hundred pounds. What did he receive for the milk?

11. Find the cost of 90 pounds of wheat at $1.20 a bushel.

A DAIRY ACCOUNT

Many farmers send their milk to creameries to be churned into butter. The farmers are paid by the creameries according to the percentage of butterfat the milk contains. Below is an account which a creamery kept with seven of its customers. The table shows the average results of the Babcock test, which tests the percentage of butterfat in the milk.

Name	Pounds of Milk	Per Cent of Butterfat	Pounds of Butterfat	Price a Pound	Value
J. Brain	7,380	3.8	?	32¢	?
Wm. Casper	6,350	4.2	?	33¢	?
Ole Johnson	9,500	4.1	?	33¢	?
Henry Merten	6,200	3.7	?	32¢	?
J. E. Simpson	5,150	3.9	?	32¢	?
John Veland	4,650	4.3	?	33¢	?
C. J. Smith	6,840	3.6	?	32¢	?

1. Which farmer's milk had the largest per cent of butterfat?

2. How much larger was the test for butterfat for J. Brain's milk than for C. J. Smith's milk?

Think: $3.8\% - 3.6\% = ?\ \%$

3. What was the average per cent of butterfat for the seven accounts?

4. How many pounds of butterfat did Mr. Brain's milk yield?

Think: 3.8% of 7,380 lb. $= .038 \times 7{,}380 = ?$ lb.

5. Find the pounds of butterfat sold by each of the men.

6. Each man was paid the prices given in the table for butterfat. Find how much each man should receive from the creamery.

THE HOMING PIGEON

1. It takes the Capital Limited on the B. & O. Railroad 3 hours 29 minutes to run from Cumberland to Washington. A homing pigeon flew this distance in 1 hour 54 minutes. How much longer than the homing pigeon did it take the train?

2. A homing pigeon was taken by automobile from its home loft to a place 180 miles away. It took the automobile 5 hours 56 minutes to reach the place. The pigeon was immediately released, and flew back to its home in 4 hours 48 minutes. How long was the pigeon away from its home on this trip? What was the pigeon's speed in miles an hour? in yards a minute?

3. A good average speed for a homing pigeon is 1,200 yards a minute. How many yards is this an hour? how many miles an hour?

4. How does the speed that you found for the homing pigeon in problem 2 compare with the average speed?

*5. During the World War "Big Tom," a homing pigeon, was released at 2:35 o'clock one afternoon. Though wounded by a bullet from a machine gun, it delivered its important message at a village 24 miles away at exactly 4:00 P.M. What was "Big Tom's" speed in miles an hour?

*6. "Bill of Atlanta," another homing pigeon, won first place in a 500-mile race. How long do you think it took him? If he made as good speed as the pigeon in problem 2, how long did it take him? If he could fly as fast as "Big Tom," how long did it take him to fly 500 miles?

USES OF UNITS OF MEASUREMENT

What unit of measurement would you use to express each of the following:

1. The length of a city block?
2. Your height?
3. The capacity of a pail?
4. The weight of the coal in the earth?
5. The amount of cream in a small bottle?
6. The area of the kitchen floor?
7. The weight of a small package of spice?
8. The volume of a small cube?
9. The amount of wheat in a car?
10. The distance from Chicago to Detroit?
11. The area of the state of Texas?
12. The area of a farm?
13. The amount of water in a big reservoir?
14. The length of time it takes a sprinter to run 100 yards?
15. The amount of gasoline used on a trip?
16. The greatest depth of the ocean?
17. The amount of corn produced on an acre?
18. The volume of a large box?

EVERYDAY USES OF DENOMINATE NUMBERS

1. Helen is 4 feet 6 inches tall. How much shorter is she than Tom, who is 5 feet 4 inches tall?

2. Margaret needs three pieces of ribbon, each 2 feet 4 inches in length. How much ribbon does she need in all?

3. Our school begins at 8:45 in the morning and we have recess at 10:15. How long is it from the beginning of school to recess?

4. The floor of our dining room is 12 feet 6 inches long and 10 feet 4 inches wide. What is its area?

5. How much more gasoline must I put into a 14-gallon tank to fill it if there are already 3 gallons 1 quart in the tank?

6. Marjorie had a piece of lace 5 feet 8 inches long. She cut it into four equal pieces. How long was each piece?

7. What is the volume of a cake of ice 1 foot 3 inches long, 1 foot 2 inches wide, and 18 inches thick? Express the answer in cubic feet.

8. One morning Jack picked 48 quarts of strawberries. How much more than a bushel did he pick?

9. A butcher sold 3 pounds 8 ounces of meat at 48 cents a pound. How much did he charge for the meat?

10. Alice made 3 pounds 6 ounces of candy which she wished to divide into 4 equal parts. How many ounces should she put into each part?

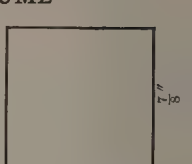
11. Harry walked 4 miles in 1 hour and 15 minutes. How long did it take him on the average to walk a mile?

12. How much molding would be needed for a strip around a room 12 feet 6 inches long and 10 feet 8 inches wide?

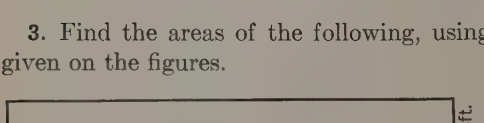
MEASURING AREA AND VOLUME

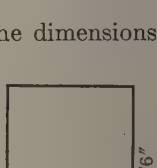
1. Is this square equal to a square inch? Use your ruler to measure it.

2. Find the area of each of the following figures. Use your rulers to find the dimensions.

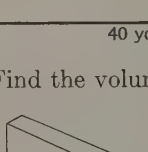


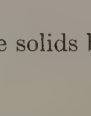
3. Find the areas of the following, using the dimensions given on the figures.

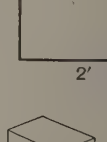




4. Find the volume of the solids below.

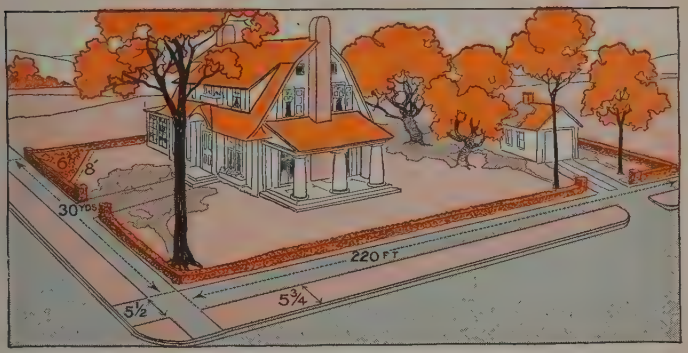






5. If the dimensions of a solid are in inches, the volume will be in .....

6. If the dimensions of a rectangle are in rods, the area will be in .....



MR. BROWN'S HOME

1. This is the picture of the home which Alfred's father, Mr. Brown, has just purchased for $15,000. He paid 25% of this sum in cash. How much cash did Mr. Brown pay down when he purchased the property?

2. How much does he owe on the property? What per cent of the entire cost is this?

3. If Mr. Brown pays $2,250 on this debt every year, in how many years will he pay off the debt on his home?

4. The lot is 220 feet along the street and 30 yards deep. What part of an acre is it? (43,560 sq. ft. = 1 acre.)

5. Lots in that part of the city are worth $15 a front foot. What is Mr. Brown's lot worth?

6. What part of the cost of the whole property is the value of the lot? Reduce your answer to a decimal.

7. The sidewalk on each side of the street in front of this home is $5\frac{1}{2}$ feet wide. It is $5\frac{3}{4}$ feet from the edge of the sidewalk to the curb, and $57\frac{1}{4}$ feet from curb to curb. What is the entire width of the street in front of Mr. Brown's home?

8. Alfred laid out the triangular pansy bed which you see at the left of the house. It is a right triangle in shape. The base is 8 feet and the altitude 6 feet. How many square feet are in the pansy bed?

9. Mr. Brown bought the following pieces of lumber to repair the garage:

8 boards 1″ x 8″ x 10′ at $28 a M.

10 pieces of lumber 2″ x 4″ x 10′ at $32 a M.

What was the total cost of the lumber?

10. Mr. Brown had two apple trees. From one he picked 2 bushels 3 pecks, and from the other he picked 5 bushels 1 peck. He sold the apples for $2 a bushel. What did he receive for them?

PRACTICE TESTS IN FRACTIONS

You should be able to find the answers to the examples in each of the following sets in less than 10 minutes.

Addition Practice Test IV

1.	3.	5.	7.	9.	11.
$\frac{1}{6}$	5	$\frac{1}{8}$	$\frac{1}{3}$	$8\frac{2}{3}$	$\frac{2}{3}$
$\frac{1}{6}$	$2\frac{7}{8}$	$2\frac{1}{8}$	$\frac{1}{6}$	$5\frac{3}{4}$	$\frac{1}{4}$
					$4\frac{1}{12}$

2.	4.	6.	8.	10.	12.
$2\frac{1}{3}$	$9\frac{2}{3}$	$\frac{1}{4}$	$8\frac{1}{5}$	$\frac{2}{5}$	$2\frac{17}{24}$
$3\frac{7}{12}$	$7\frac{5}{6}$	$\frac{5}{6}$	$7\frac{1}{6}$	$1\frac{2}{3}$	$4\frac{5}{6}$
		$\frac{1}{8}$			$3\frac{5}{8}$

Subtraction Practice Test IV

1.	3.	5.	7.	9.	11.
$4\frac{2}{3}$	$4\frac{3}{5}$	1	$2\frac{1}{8}$	$1\frac{1}{8}$	$8\frac{1}{8}$
$\frac{2}{3}$	$2\frac{1}{5}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{3}$	$1\frac{1}{2}$

2.	4.	6.	8.	10.	12.
$9\frac{3}{5}$	$3\frac{3}{4}$	$3\frac{5}{6}$	$\frac{1}{3}$	$3\frac{1}{4}$	$2\frac{1}{6}$
$8\frac{4}{5}$	$\frac{1}{2}$	$1\frac{2}{3}$	$\frac{1}{4}$	$1\frac{2}{3}$	$\frac{2}{3}$

Multiplication Practice Test IV

1. $\frac{2}{3} \times 16 =$
2. $6 \times 2\frac{1}{3} =$
3. $\frac{5}{8} \times 6\frac{2}{5} =$
4. $4\frac{3}{8} \times 2\frac{6}{7} \times 1\frac{4}{5} =$
5. $4 \times \frac{1}{2} =$
6. $6 \times 4\frac{3}{8} \times 2\frac{4}{5} =$
7. $3\frac{1}{8} \times \frac{1}{8} =$
8. $25\frac{1}{2}$ / 27
9. $\frac{1}{4} \times \frac{8}{9} =$
10. $3\frac{2}{3} \times 8 =$
11. $2\frac{1}{4} \times 2\frac{1}{4} =$
12. 18 / $4\frac{3}{4}$

Division Practice Test IV

1. $14 \div \frac{4}{5} =$
2. $\frac{1}{5} \div 5 =$
3. $\frac{5}{12} \div 1\frac{5}{6} =$
4. $3\frac{1}{3} \div 1\frac{3}{4} =$
5. $\frac{3}{8} \div \frac{3}{8} =$
6. $10 \div 6 =$
7. $3 \div 4\frac{1}{2} =$
8. $6 \div 3\frac{1}{2} =$
9. $3\frac{1}{2} \div \frac{1}{2} =$
10. $5\frac{3}{5} \div 2 =$
11. $12 \div 6\frac{3}{5} =$
12. $1\frac{1}{2} \div 4\frac{1}{2} =$

Practice these sets of examples until you can do them all correctly in the time allowed.

PRACTICE TEST IN DECIMALS IV

You should be able to find the answers to the following examples in less than 10 minutes.

1. Express as decimals: $\frac{2}{5}$, $\frac{2}{3}$, $\frac{1}{6}$, $\frac{16}{25}$, $\frac{17}{75}$.
2. Express as common fractions: .2, .75, .08, .875, .83$\frac{1}{3}$.
3. Find the sum of .4, .6, .7, .9, .1.
4. Subtract: (*a*) 4.625 from 15; (*b*) 37.2 from 38.1.
5. Multiply: (*a*) $7 \times .08$; (*b*) 6.5×5.7; (*c*) $1{,}000 \times .012$.
6. Divide: (*a*) $25\overline{)8.625}$; (*b*) $.2\overline{)72}$; (*c*) $6.48\overline{)7.128}$.

Practice these examples until you can do all of them correctly in the time allowed.

PRACTICE WITH PER CENTS

1. Express as per cents: .07, 1.2, .5.
2. Express as decimals: 6%, 10%, 125%.
3. Find 4% of: 18; 125; 78.
4. 15 = —% of: 30, 60, 10, 5.

SHORT TESTS IN MIXED PROCESSES

Test I

1. 562
619
516
441
375
148

2. Subtract
7.964
4.85

3. 7.48×2.3

4. $7\frac{1}{2} \times 6\frac{2}{5} =$

5. $9\frac{1}{2} - 7\frac{3}{4} =$

6. $4.8\overline{)97.64}$

7. 20% of 400 =

Test II

1. 669
430
388
599
580
607

2. Subtract
47.6
25.375

3. $36 \times 7\frac{7}{8}$

4. $2.49 \times .08$

5. $6\frac{7}{8} \div 1\frac{1}{4} =$

6. $8.3\overline{)318.99}$

7. 7% of 420 =

Test III

1. Add 46.5, 27.36, 482, .75, and 3.6.
2. Subtract 59.85 from 107.375.
3. Multiply 375 by 1.8.
4. Multiply 4.8 by 2.5.
5. Divide 99.82 by 7.
6. Divide 675 by 2.5.
7. Find 8% of $750.

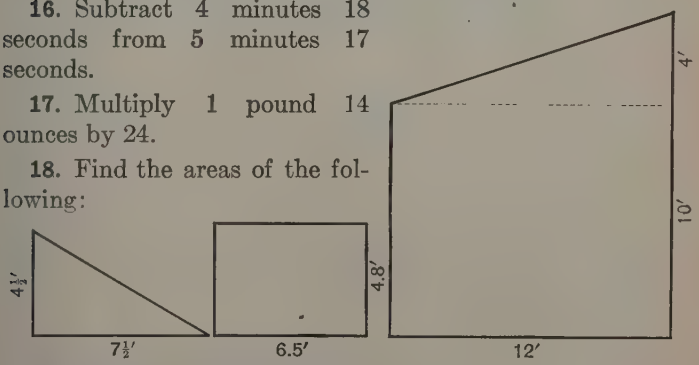
Test IV

1. Add .375, 375, 3.75, 37.5, and 3,750.
2. Subtract 3.3 from 3.375.
3. Multiply 4.25 by 1.7.
4. Multiply 5.97 by 46.
5. Divide $8\frac{1}{2}$ by 7.
6. Multiply: $7\frac{1}{2} \times 6\frac{2}{3} \times \frac{1}{5} = ?$
7. 80% of 400 = ?

DIAGNOSTIC TEST NO. V

This exercise will test your ability to work different kinds of examples.

1. $4\frac{1}{3} + 2\frac{2}{4} + 6\frac{1}{2} =$
2. $8\frac{1}{2} - 4\frac{3}{4} =$
3. $5\frac{1}{2} \times 2\frac{2}{3} \times 3\frac{1}{5} =$
4. $16\frac{2}{3} \div 8\frac{1}{3} =$
5. Find the sum of .004, 1.7, 368, and .04.
6. Subtract 6 from 9.125.
7. Find the product of 30 and 7.5.
8. Divide 17.28 by 90.
9. Express $\frac{3}{4}$ as a decimal and as a per cent.
10. Change $62\frac{1}{2}\%$ to a decimal and to a fraction.
11. Find 6% of 250; 300; 850; 75.
12. What per cent of 200 is 60? 50? 80? 400?
13. 25 = —% of 60.
14. 125% of 360 = —.
15. Add 4 feet $3\frac{1}{2}$ inches and 5 feet $10\frac{3}{4}$ inches.
16. Subtract 4 minutes 18 seconds from 5 minutes 17 seconds.
17. Multiply 1 pound 14 ounces by 24.
18. Find the areas of the following:



19. Divide 5 bushels 10 quarts by 10.

20. $\frac{1}{2}$ = —% of 2; 25 = —% of 10?

21. 15% of \$825 = ? 120% of 60 = ?

22. Express .5 as a common fraction, and as per cent.

PROBLEM SCALE V

Standards	
Excellent	9 or 10 correct
Good	7 or 8 correct
Fair	5 or 6 correct
Unsatisfactory	0 to 4 correct

1. Alice spends 18 cents each noon for lunch. How much does she spend for lunches in 6 days?

2. Bananas weigh, on the average, about $\frac{1}{4}$ pound. What do a dozen bananas weigh?

3. How long will 75.6 pounds of sugar last if 1.2 pounds are used each day?

4. Harry can work 10 examples in 4 minutes. How many examples can he work a minute?

5. Mrs. Smith bought 12 cans of 48-cent pears at a sale for 42 cents a can. What did she save?

6. Find the cost of 50 boxes at \$8 a hundred.

7. Mr. Andrews sold 24.5 bushels of potatoes for \$30.38. What was the price a bushel?

8. Jack wished to earn \$18.50 to buy a bicycle. One Saturday he worked $7\frac{3}{4}$ hours for 40 cents an hour. How much more must he earn before he can buy the bicycle?

9. If Frank works for Mr. Smith $\frac{1}{2}$ hour before school and $1\frac{3}{4}$ hours after school each day, how many hours does he work in 6 days?

10. If $\frac{3}{4}$ bushel of peas are needed to plant an acre, how much will the seed for a 5-acre field cost at \$2 a bushel?

CHAPTER VI

SCHOOL SAVINGS BANKS

Many children have deposited money in school savings banks. This table shows how the number of depositors and the total deposits have increased since 1921.

Year	Pupil Accounts	Deposits
1921	1,295,607	$5,775,122
1922	1,907,851	10,631,838
1923	2,236,326	14,991,575
1924	2,454,326	16,961,560
1925	2,869,492	25,913,531
1926	3,403,746	31,984,052
1927	3,815,785	39,137,073

Under each of the following problems select the number which you think is nearest the correct answer. When you have done this for the first 9 problems, do the work necessary to find the correct answer.

1. The increase in the number of pupil accounts from 1921 to 1922 was about 600,000; 450,000; 700,000.

2. The increase in the number of pupil accounts from 1922 to 1923 was about 200,000; 300,000; 400,000.

3. The increase in the number of pupil accounts from 1926 to 1927 was about 400,000; 600,000; 500,000.

4. The average amount deposited a pupil in 1921 was about \$40; \$5; \$12.

5. The average amount deposited a pupil in 1922 was about \$10; \$5; \$19.

6. The average amount deposited a pupil in 1923 was about \$75; \$10; \$7.

7. The average amount deposited a pupil in 1924 was about \$5; \$8; \$80.

8. The number of pupils in 1927 was about 2, $2\frac{1}{2}$, 3, 5 times the number in 1921.

9. The total deposits in 1927 was about 2, 6, 4, 8 times the total deposits in 1921.

*__10.__ If there is a school savings bank in your school, find how many pupils have accounts, the total deposits for some week, and the average deposit a pupil.

THE MEANING OF INTEREST

1. Harry rented a rowboat at a summer camp for $2\frac{1}{2}$ hours at 20¢ an hour. What did he pay for the use of the boat?

D

2. Mr. Lewis borrowed \$100 from his bank. The bank charged 6% a year for the use of the money. If Mr. Lewis kept the loan for one year, how much must he pay the bank?

The sum which Harry paid for the use of the rowboat is called *rent*. The sum which Mr. Lewis paid for the use of the \$100 is called *interest*. Interest is money paid for the use of money.

HOW INTEREST IS PAID

When Harry's class began to deposit money in the savings bank, his teacher told the pupils that the bank would pay 4% interest a year for the use of the money. Banks usually pay half the yearly interest every six months, although some pay by the year.

1. Suppose that you lent someone \$50 at 4% a year interest. For the use of the money for one year, he would pay 4 per cent of \$50.00. How much is 4 per cent of \$50?

Think: 4% of \$50 =
$.04 \times \$50 = \$2.00$, interest for one year.

2. If he kept the money for two years, how much would be the interest on \$50 at 4%?

Think: 4% of \$50 = \$2.00, the interest for one year.
$2 \times \$2.00 = \$4.00$, the interest for 2 years.

3. Find the interest on \$200 for 1 year at 4%.

4. Find the interest on \$150 for 3 years at 6%.

5. Find the interest on \$100 for 6 months at 4% a year.

Think: 6 mo. = ? year.

6. If you lend someone \$100 at 6% interest, and he pays the loan with interest at the end of a year, how much money does he pay?

Think: 6% of \$100 = \$6.00, interest for 1 year.
\$100 + \$6 = \$106, the amount he pays.

Find the interest on the following:

7. \$200 for 1 year at 6%.
8. \$300 for 2 years at 5%.
9. \$400 for 3 years at 4%.
10. \$450 for 6 months at 6%.
11. \$840 for 1 year 6 months at 5%.
12. \$900 for 2 years at $6\frac{1}{2}$%.
13. What is the interest on \$100 for 4 months at 6% a year?

Think: 4 months = $\frac{4}{12}$ year = $\frac{1}{3}$ year.

Find the interest on the following:

14. \$200 for 8 months at 8%.
15. \$300 for 3 months at 6%.
16. \$400 for 1 year 3 months at 7%.
17. \$850 for 10 months at 4%.
18. \$950 for 2 years 4 months at $4\frac{1}{2}$%.
19. \$250 for 1 year 5 months at 8%.
20. If you deposit \$25 in a savings bank which pays 4% interest a year, payable semi-annually, what will be the total amount on deposit at the end of 6 months?

Think: Semi-annually means every six months. Since 6 months is $\frac{1}{2}$ year, the semi-annual interest would be $\frac{1}{2}$ of 4% or 2%. 2% of \$25 = ?

Find the semi-annual interest on the following:

21. \$100 at 6%
22. \$250 at 4%
23. \$800 at 8%
24. \$900 at 7%
25. \$600 at $3\frac{1}{2}$%
26. \$750 at $4\frac{1}{2}$%
27. \$840 at 6%
28. \$725 at 4%

SOME SPECIAL WORDS USED IN INTEREST PROBLEMS

The sum of money on which interest is paid is called the *principal.*

The length of time for which interest is paid is called the *time.*

The per cent of interest that is paid is called the *rate of interest.*

The principal plus the interest due is called the *amount.*

Find the interest and the amount in the following:

	Principal	Rate of Interest	Time	Interest	Amount
1.	$200	6%	2 yr.	?	?
2.	$400	4%	2 yr.	?	?
3.	$174	8%	3 yr.	?	?
4.	$250	5%	$1\frac{1}{2}$ yr.	?	?
5.	$ 75	4%	6 mo.	?	?
6.	$375	6%	8 mo.	?	?

7. Julia's father borrowed $375. He repaid the loan at the end of 6 months with interest at 6 per cent. What was the amount?

8. Which is greater, the amount of a loan of $600 at 5 per cent for 2 years, or the amount of a loan of $575 at 4 per cent for 3 years?

PROMISSORY NOTES

A man in business often borrows money. He gives the lender a *promissory note,* which is a written promise to pay the money within a certain length of time with interest as stated in the note. The man who borrows the money is called the *maker* of the note, and the man who lends him the money is called the *payee.* The amount of money borrowed is called the *face* of the note.

There are several different kinds of promissory notes. The note shown below is an interest-bearing promissory note.

$200 SEATTLE, WASH., July 3, 19—

Eight months AFTER DATE, I PROMISE TO PAY TO

THE ORDER OF John Anderson

Two hundred and no/100 DOLLARS

AT The Inland Empire Bank

FOR VALUE RECEIVED, WITH INTEREST AT 6 %.

Wm. J. Pelo

1. How much money was lent?

2. Where was the note made? when? Who is the maker? the payee?

3. For how long a time was the money lent? On what date was it due? Where was it payable?

4. What was the rate of interest? How much interest must Wm. J. Pelo pay for the money that he borrowed?

5. If this money had been lent for three months, when would it have been due?

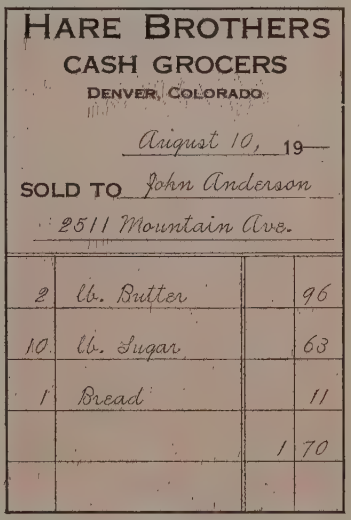
6. If it had been lent for four months, when would it have been due?

7. If the note had been due in 60 days, on what date would it have been due? (Do not count July 3.)

*8. Write in complete form a promissory note for $40. Make yourself the maker and some friend the payee. Make the note for 60 days from today with interest at 6%. Find when the note will come due, and the amount due the payee at maturity.

SALES SLIPS

When a customer buys groceries at a store, the clerk usually writes a sales slip listing the articles of merchandise, the cost of each item, and the total cost. Here is a picture of a sales slip.


HARE BROTHERS
CASH GROCERS
DENVER, COLORADO

August 10, 19—

SOLD TO John Anderson
2511 Mountain Ave.

2	lb. Butter		96
10	lb. Sugar		63
1	Bread		11
		1	70

Hare Brothers are called *retail dealers*, because they sell directly to consumers. Hare Brothers sell only for cash. They do not have *charge accounts*.

Make out sales slips for each of the following orders. Use local prices.

1. Mrs. Harry Teal,
327 South Ann St.
2 lb. butter
$\frac{1}{2}$ doz. eggs
5 lb. sugar
$1\frac{1}{2}$ lb. lard

2. Thomas Farley,
264 Harriet St.
1 pk. potatoes
1 doz. bananas
3 cans of corn

3. James Hobson.
316 Maple Ave.
3 cans tomatoes
2 lb. lard
2 doz. eggs
5 cans tomato soup

4. Harry Steel,
6420 Dupont Ave.
3 cans vegetable soup
$1\frac{1}{2}$ doz. eggs
1 lb. cookies

5. Mrs. Elizabeth Morton,
18 Bethany Block
$\frac{1}{2}$ pk. potatoes
1 can Crisco
3 glasses peach jelly
3 lb. onions

CASH AND CREDIT

A store which keeps an account of an entire month's purchases to be paid for when the month's bill is presented is said to be doing a *credit* business.

If a store does a credit business, its customers are given sales slips. Sometimes the sales slips give only the items purchased and the amount of the order. Sometimes, as in the following sales slip, they also contain a statement of the amount of money due the store for purchases made previously.

JOHNSON'S GROCERY
TENTH AND JACKSON

Minneapolis, January 7, 19—

James Lewis,
2511 Garfield Ave., South,
Minneapolis, Minn.

BALANCE FORWARDED		10	61
2 lb. butter	96		
1 lb. cheese	42		
1 doz. eggs	37		
10 bars soap	45	2	20
Received Payment		12	81
February 6, 19—			
Johnson's Grocery By Logan Smythe			

1. To whom was the sales slip made out?

2. "Balance Forwarded" indicates the amount due the store from purchases made previously. What amount should appear in this place on the next sales slip?

ARITHMETIC OF A CLERK

A Grocery Clerk's Arithmetic

The following sales were made by a clerk in a grocery store. Find the amount of each sale.

1. $4\frac{1}{2}$ pounds of lard @ 22¢ a pound.
2. $2\frac{1}{4}$ pounds of coconut @ 32¢ a pound.
3. $\frac{1}{2}$ pound of crackers @ 21¢ a pound.
4. 8 eggs @ 30¢ a dozen.
5. 6 bushels of potatoes @ $1.76 a bushel.
6. 5 pounds of sugar @ $7\frac{1}{2}$¢ a pound.

A Dry Goods Clerk's Arithmetic

Find the cost of:

7. $3\frac{1}{2}$ yards of gingham @ 56¢ a yard.
8. $5\frac{1}{4}$ yards of voile @ 31¢ a yard.
9. $\frac{3}{7}$ yard of ribbon @ 20¢ a yard.
10. $8\frac{3}{4}$ yards of muslin @ 19¢ a yard.
11. 15 handkerchiefs @ 25¢ each.
12. $22\frac{3}{4}$ yards of trimming @ 20¢ a yard.

Give these products mentally:

13. $1\frac{1}{2} \times 12$
14. $1\frac{3}{4} \times 16$
15. $2\frac{1}{2} \times 10$
16. $3\frac{1}{3} \times 15$
17. $2\frac{1}{4} \times 20$
18. $4\frac{1}{8} \times 16$
19. $12 \times 4\frac{1}{2}$
20. $6 \times 1\frac{3}{4}$
21. $7 \times 2\frac{1}{2}$
22. $4 \times 2\frac{3}{4}$
23. $5 \times 3\frac{1}{5}$
24. $6 \times 2\frac{1}{4}$
25. $1\frac{1}{8} \times 16$
26. $5 \times 12\frac{1}{2}$
27. $8 \times 5\frac{1}{4}$
28. $6 \times 3\frac{7}{8}$
29. $2 \times 3\frac{5}{8}$
30. $4\frac{3}{4} \times 10$

Find the cost of the following:

31. 12 ounces of coconut at 28¢ a pound.
32. 18 inches of ribbon at 40¢ a yard.
33. 2 pecks of potatoes at $1.20 a bushel.
34. 1 pound 2 ounces of cheese at 48¢ a pound.
35. 2 pounds 8 ounces of meat at 40¢ a pound.

MAKING OUT RECEIPTS

At the beginning of each month Jack Andrews collected from each of the customers on his newspaper route. He gave receipts for the money. This is one of the receipts.

$ .70 Philadelphia, Pa., July 3, 19—

Received of Frederick Ortung

Only 70/100 Dollars

for the month of June.

Jack Andrews

Carrier

1. To whom did Jack give the above receipt?
2. How much money did Jack receive?
3. Make a list of the items included in the receipt.
4. Why did Jack give receipts to his customers?

In place of a separate receipt, the bill may be receipted as shown on page 194.

5. Why is it a good plan for people to save receipts?
6. Make out a bill for the following items. Use the name of some local store as the name of the firm making out the bill. Receipt the bill.

$4\frac{1}{2}$ yd. cloth.....@	$.70	Misses' hat.....	$3.75
$6\frac{3}{4}$ yd. cloth.....@	.35	Misses' dress.....	18.00

7. Make out a receipt for money that you might receive from some classmate for tickets sold for a school play.
8. Why are receipts usually not given by small stores for cash sales?

D

BILLS AND STATEMENTS

Below is a monthly bill of purchases made by a person who had an account at a department store.

JOHNSON MERCANTILE CO.
17 SOUTH FIFTH STREET
PHILADELPHIA, PA.

January 3, 19—

SOLD TO James Anderson
2511 Garfield Avenue
Wayne, Pa.

Terms: All bills of each month due and payable on or before the 10th of the following month. No receipts given unless requested. $

DATE		MEMO.	CHARGES	CREDITS	BALANCE
Dec.	3	2 mats	1 00		1 00
	8	4 shirts	5 60		6 60
	9	Ret. 2 shirts		2 80	3 80
	21	Pr. gloves	2 25		6 05
	27	Sauce pan	45		6 50

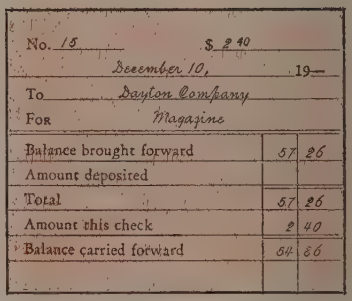
OUR BOOKS SHOW YOUR BALANCE TO BE LAST AMOUNT IN THIS COLUMN

1. What company sent the bill?
2. To whom was the bill sent? Where did he live?
3. In what month were the purchases made?
4. When was the bill payable?
5. Why are the dates given?
6. Why are the names of articles purchased listed?
7. What is meant by charges? by credits? by balance?

8. Why did Mr. Anderson receive credit for the two shirts returned?

9. What was the total amount due the company?

10. Check the bill to see if the balances are correct.



No. 15 $ 2 40

December 10, 19—

To Dayton Company

For Magazine

Balance brought forward	57	26
Amount deposited		
Total	57	26
Amount this check	2	40
Balance carried forward	54	86

*__11.__ Rule bill forms like the bill on page 197. Use your name as that of the buyer. Let someone in the class be the seller. Make up a list of items suggested by each of the following topics. Find the cost of each item. Then find the total of each bill.

a. equipment for baseball
b. equipment for Girl Scout
c. supplies for a party
d. tools for a tool chest

PAYING BILLS WITH CHECKS

Checks are used frequently in the payment of bills because they are convenient, and because a canceled check is a receipt for the sum on its face.

1. On what date was the check on page 199 written?

2. What is the number of the check? Why do people number their checks?

3. What is the name of the bank?

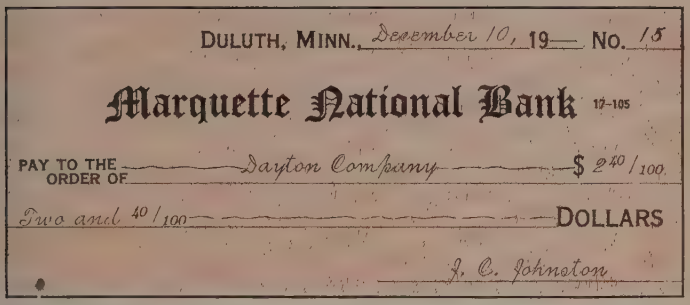
4. Where is the bank located?

5. For how much money was the check made out?

6. To whom is the money to be paid?

7. Who signed the check?

8. Why is the amount of money indicated both by number and by word?


DULUTH, MINN. December 10, 19— No. 15

Marquette National Bank 12-105

PAY TO THE ORDER OF Dayton Company $ 240/100

Two and 40/100 DOLLARS

J. C. Johnston

9. Mr. Johnston keeps, on a stub (page 198), a record of each check that he writes. Explain each entry on the stub.

10. What does *Pay to the order of* mean?

When Dayton Company receives the check, they *indorse* it by writing, or stamping, the name of the company on the back of the check. Then the bank cashes the check and stamps *Paid* on the check. At the end of the month the bank lists all of Mr. Johnston's checks on a statement and returns them to him.

11. Choose the name of a bank and make out a check in payment of one of the following bills. Use the picture of the check above as a model.

12. J. Dreiman, grocer, $35.26.

13. H. C. Smith, florist shop, $3.75.

14. J. B. Andrews, garage, $8.00.

15. Joseph Buchanan, coal dealer, $17.50.

16. George Mansley, plumber, $84.06.

*__17.__ May a person write a check which he can cash himself?

*__18.__ Are checks from your local bank like the one shown above?

BALANCING CASH ACCOUNTS

Boys and girls should learn to keep an account of all the money they receive and pay out. Such an account is called a *cash account.* At the end of the month cash accounts should be *balanced.*

Study carefully the following cash account which was kept by Harry Wilson for the month of August:

RECEIVED					PAID OUT				
19— Aug.	1	On hand	5	30	19— Aug.	4	Ticket, ball game		25
	9	Allowance	2	50		11	Picnic expenses		54
	16	Mowing lawn	1	25		19	Baseball	1	25
	18	Caddying		90		23	Cap		90
	24	Errands		75		26	Gift for Tom	1	00
	27	Caddying		50		31	Balance		?
				?					?
Sept.	1	On hand		?					

1. Balance the account as follows:

a. Find how much Harry paid out in August.

b. Find the amount of cash on hand at the beginning of the month and the money received during the month.

c. The difference between these sums should equal the amount that Harry had left at the end of the month, or the balance. Harry had $7.26 left at the end of the month. Does this check with his account? If it does, we say that the account *balances.*

2. What amount will Harry write as *Cash on hand* on September 1?

3. Keep a personal cash account for one week.

MAKING OUT ACCOUNTS

Rule an account form like the one used by Harry Wilson. Enter the following transactions and balance the accounts.

1. Tom Wilson's account for August:

Aug. 1. Balance from July, $5.25
Aug. 3. Earned by errands, 35¢
Aug. 5. Spent for baseball, $1.50.
Aug. 10. Earned for washing car, $1.25
Aug. 15. Received monthly allowance, $1.00
Aug. 18. Sold baseball bat to Jim Rogers, 65¢
Aug. 23. Received for working in garden, 75¢
Aug. 25. Paid for repair of bicycle, 60¢
Aug. 27. Received for helping George Brown on his newspaper route, $1.75
Aug. 30. Put in savings bank, $2.50.

2. Mabel Serle's account for December:

Dec. 1. Balance from November, $9.80
Dec. 5. Received for helping mother, $2.50
Dec. 7. Paid for material for Christmas presents, $1.40
Dec. 9. Bought Christmas seals, $.50
Dec. 15. Received monthly allowance, $2.50
Dec. 18. Received present from Aunt Sarah, $5.00
Dec. 19. Paid for Christmas presents, $3.00
Dec. 20. Paid for stamps, 25¢
Dec. 21. Deposited in school savings bank, $2.00
Dec. 22. Hair cut, 50¢
Dec. 23. Present for Kate, $1.10
Dec. 24. Earned at store, $1.50
Dec. 25. Movie, 25¢
Dec. 26. Movie, 25¢
Dec. 28. Mailed package, 28¢
Dec. 30. Earned at store, $1.50

A FAMILY BUDGET

The average amounts spent for different purposes in a year by a family of five persons are as follows:

		Amount	Per Cent	Amount a Month
Food		$774	?	?
Clothing:				
Husband	$120			?
Wife	166			?
Boy (11 yr.)	96			?
Girl (5 yr.)	82			?
Boy (2 yr.)	47			?
Total		?	?	?
House, fuel, and light		428	?	?
Miscellaneous		547	?	?
Total		?	?	?

1. What was the total amount spent for clothing?

2. What was the total amount spent for all items?

3. What per cent of the total was spent for food? for clothing? for house, fuel, and light? for miscellaneous items?

4. What should the sum of these per cents equal?

5. How much is allowed a month for food? for each of the other items?

A plan for spending an amount of money is called a *budget.*

6. According to the table, how much did the 11-year-old boy spend a month for clothing? Does this seem to you to be enough?

***7.** Prepare a list of the articles of clothing that you need in a year, and estimate their total cost.

FINDING DISCOUNTS AT PER CENT-OFF SALES

Helen bought a $5.00 sweater at a 20%-reduction sale. What did she pay for the sweater?

> Think: The reduction was 20% of $5.00.
> 20% of **$5.00** = .20 × **$5.00** = **$1.00**.
> Helen therefore paid **$5.00** − **$1.00**, or **$4.00** for the sweater.

Find the selling prices of the following:

	Regular Price	Per Cent Off	Reduction	Selling Price
1. Shoes	$4.50	10%	?	?
2. Bicycle	$24.00	25%	?	?
3. Skates	$3.75	20%	?	?
4. Book	$2.50	50%	?	?
5. Scissors	$1.20	$33\frac{1}{3}$%	?	?
6. Sweater	$4.56	25%	?	?
7. Shovel	$2.25	20%	?	?
8. Baseball	$1.80	5%	?	?
9. Overcoat	$32.00	$12\frac{1}{2}$%	?	?
10. Dress	$16.00	30%	?	?

11. Mrs. Smith went to a sale to buy a suit for Jack and a coat for Mary. She bought a $25 suit for Jack at 20% off, and a $30 coat for Mary at 25% off. How much did she save by buying the suit and coat at the sale?

12. Jack bought a bicycle for $30. After he had used it two years, he offered it for sale at a reduction of 40%. What did he ask for the bicycle?

13. Arthur's father bought an automobile for $1,000. After he had used it a year, he advertised it for sale at 20% reduction. What was his selling price?

FINDING THE PER CENT REDUCTION

Harry saw a $24 bicycle advertised for $18.00. What was the reduction in price? What per cent was that of the regular price?

Think: The reduction was $6.00 ($24.00 − $18.00 = $6.00)
$6.00 is what per cent of $24.00?

Find the per cent off on each of the following:

	Regular Price	Sale Price	Reduction	Per Cent Reduction
1. Field glasses.....	$8.00	$6.00	?	?
2. Automobile tire.....	16.00	12.00	?	?
3. Cushion.....	5.00	3.50	?	?
4. Cookbook.....	3.60	3.24	?	?
5. Tent.....	25.00	15.00	?	?
6. Camera.....	22.50	20.00	?	?

A MIXED DRILL

Practice this exercise until you can find the answers to each of the two sets in less than 8 minutes:

Set I

	a	*b*	*c*
1.	$\frac{1}{4}$ of 200 =	75% of 1,000 =	60% of 50 =
2.	$\frac{1}{3}$ of 600 =	.4 of 25 =	$\frac{5}{8}$ of 160 =
3.	$12\frac{1}{2}$% of 96 =	$83\frac{1}{3} \times 12$ =	$16\frac{2}{3}$% of 48 =
4.	$.66\frac{2}{3} \times 1{,}200$ =	$62\frac{1}{2}$% of 160 =	56 = 14 × —
5.	$\frac{1}{2}$ of 20 =	84 = —% of 144	45 = —% of 75

Set II

1.	$66\frac{2}{3}$% of 1,500 =	$.62\frac{1}{2} \times 240$ =	50% of 20 =
2.	.8 of 250 =	20% of 400 =	$.375 \times 80$ =
3.	$\frac{1}{6}$ of 48 =	$.33\frac{1}{3} \times 600$ =	$\frac{4}{5}$ of 250 =
4.	$.875 \times ? = 70$	$\frac{2}{3}$ of 1,200 =	48 = —% of 64
5.	$\frac{2}{5}$ of 25 =	$\frac{5}{6}$ of 12 =	475 = — × 125

DISCOUNTS FOR CASH

In order to encourage prompt payment, many business concerns allow a discount if bills are paid before a certain date. Sometimes the discount is a certain amount of money. Sometimes it is a certain per cent of the bill.

The Brown family received the following bills:

1. A telephone company charged $3.00 for telephone service if the bill was paid before the 15th of the month. After the 15th, the bill became $3.50. How much was the discount? What per cent of $3.00 is this? What per cent of $3.50?

2. The gas bill amounted to $4.20. Five per cent discount was allowed if the bill was paid before the 20th of the month. The bill was paid on the tenth of the month. How much was paid by Mr. Brown?

3. An electric bill amounting to $3.24 was sent to Mr. Brown. A discount of 2% was allowed if the bill was paid before the 27th of the month. Mr. Brown paid the bill on the 25th. What was the amount of the discount?

4. Mrs. Brown had a charge account at a department store. The bill for the month amounted to $24. The store gave stamps worth 1 cent for each dollar, if the bill was paid before the tenth of the month. What was the value of the stamps Mrs. Brown received if she paid the bill on the second of the month?

5. What was the amount the Browns saved this month by paying their bills before they were due?

6. At this rate, what amount would they save in one year?

***7.** What discounts are allowed by some of the business houses in your community?

PROFIT AND LOSS

1. Mary Andrews planted a garden. She paid \$.75 for seed. She sold \$5.25 worth of vegetables and flowers to the neighbors. What was her *gross* profit?

To find *gross profit*, subtract the money Mary spent for seed from the amount she received. \$5.25 − \$.75 = ?

2. Mary had to spend \$.45 for insect poison during the summer. What was her net profit?

To find *net profit*, subtract the amount Mary spent for insect poison from her gross profit.

3. A grocer bought 80 bushels of potatoes at \$1.75 a bushel and sold them at \$2.25 a bushel. What was his gross profit on a bushel? on the 80 bushels?

4. The grocer estimated that the cost of selling the potatoes was \$.30 a bushel. What was his net profit on a bushel of potatoes? on the 80 bushels?

5. Harry Johnson bought 24 toy balloons for 5¢ each. The wind blew 14 of them away. He sold the rest for 10¢ each. Did he gain or lose, and how much?

Whenever one sells a thing for less than it costs, one is said to sell at a *loss*.

6. A shoe merchant bought a pair of shoes for \$4.25 and sold them for \$5.25. Would it be correct to say that his net profit was \$1? Why?

7. A farmer sold 425 bushels of wheat at \$1.29 a bushel. He estimated the cost of raising the wheat at \$.65 a bushel. He paid \$14.65 for freight and \$8.79 to the broker who sold the wheat for him. What was his net profit?

8. What is the net profit of a dealer on a sale of \$4,000, if his rate of net profit is $6\frac{1}{2}\%$ of sales?

D

A CORN PROJECT

Henry Mann lived on a farm. He decided that he would raise a field of seed corn. Mr. Mann agreed to rent Henry a three-acre field at $8 an acre for the season. Henry was to pay for the seed and pay all expenses of preparing the ground.

1. Henry used a half bushel of seed corn which was sold for $7.00 a bushel. What did the seed corn cost Henry?

2. How many pounds does a bushel of shelled corn weigh? How many pounds of seed did he plant an acre?

The record of Henry's expenses is on page 208.

3. Find the total cost of the man labor which Henry hired.

4. Henry husked the corn himself. He worked 15 hours. At 30¢ an hour, what was his labor worth?

5. Find the cost of the horse labor for each kind of work.

LABOR RECORD

WORK	HIRED MAN LABOR			HORSE LABOR			USE OF IMPLEMENTS		
	HOURS	PRICE AN HOUR	TOTAL COST	HOURS	PRICE AN HOUR	TOTAL COST	HOURS	PRICE AN HOUR	TOTAL COST
Spring Work:									
Plowing	24	$.30	?	72	$.12	?	24	$.06	?
Disking	$9\frac{1}{3}$	.30	?	28	.12	?	$9\frac{1}{3}$	.06	?
Dragging	3	.30	?	9	.12	?	3	.06	?
Planting	$4\frac{1}{2}$	.30	?	9	.12	?	$4\frac{1}{2}$	.06	?
Summer Work:									
Cultivating	24	.30	?	30	.12	?	30	.06	?
Fall Work:									
Husking	—	—	—	15	.12	?	15	.06	?
Totals	?	.30	?	?	.12	?	?	.06	?

6. Find the total cost of the horse labor.

7. What was the total cost of the labor for which Henry had to pay? Would you count Henry's own labor? Explain.

8. What did Henry pay for the use of the implements?

9. In the fall Henry harvested 250 bushels of corn from the three acres. How many bushels was this an acre?

10. Corn was selling at 98¢ a bushel. What did Henry receive for his corn?

11. Make a list of Henry's total expenses for the season.

Cost of seed ..... _____
Cost of hired labor ..... _____
Cost of horse labor ..... _____
Rent of field ..... _____
Use of implements ..... _____
Total ..... _____

12. What was Henry's profit on his corn project?

THE DIFFERENCE BETWEEN MARGIN AND PROFIT

1. My father buys eggs, cream, butter, fruit, and vegetables from farmers and sells them to his customers. Today he bought 14 dozen eggs from Mr. Smith at 25¢ a dozen. What was the total cost of these eggs?

2. My father fixed a price of 28¢ a dozen for the eggs. He calls the difference between what he pays for the eggs and what he gets for them his *margin*. What was his margin on 1 dozen eggs? If he sold all the eggs he bought from Mr. Smith at 28¢ a dozen, what was his total margin?

3. He said 3¢ was a narrow margin on which to sell the eggs. If he had sold the eggs at a margin of 6¢ a dozen, (*a*) what would the selling price a dozen have been? (*b*) At this price, what would he receive for the 14 dozen eggs? My father said that 6¢ a dozen would be a *wide margin*.

4. We buy breakfast food by the case. One kind has 18 boxes to the case. It costs $2.88 a case. What does it cost a box?

5. We sell this breakfast food at 20¢ a box. What is the margin on a box? on a case?

6. Last week, we bought two dozen baskets of grapes for $3.60. What did they cost a basket?

7. We sold 17 baskets during the week at 25¢ a basket.

a. How much did we get for them?

b. How much did these 17 baskets cost?

c. How much was our total margin on them?

8. On Monday the grapes which we had left did not look fresh, and we had to sell the baskets at cost.

a. How much did we receive for these baskets if we sold all of them at cost?

b. How much was the total amount which we received for the 24 baskets of grapes?

c. How much was our total margin on the sale of all the grapes?

9. Last week we bought 36 baskets of peaches at 22¢ a basket.

a. How much was the total cost of these peaches?

b. We sold $\frac{1}{2}$ of the baskets at 30¢ a basket. How much did we receive for them?

c. The rest partly spoiled. To get rid of them we offered them at 15¢ a basket. We sold 9 baskets at this price. How much did we get for all we sold at this price?

d. We had to throw away the rest. How many baskets did we throw away?

e. How much did we receive for all the peaches sold?

10. If we buy some dairy butter at 45¢ a pound, and sell it at a margin of $\frac{1}{5}$ of the cost, what will be the selling price a pound?

My father explained to me the difference between margin and profit. "Some people think," he said, "that if a grocer buys eggs at 40¢ a dozen and sells them at 45¢ a dozen, he makes a profit of 5¢ a dozen on them. This is not his profit, but his margin. The grocer has many expenses. He has, for instance, clerk hire, the rent for the store building, the expenses of the car used in delivering the groceries, the cost of telephone, wrapping paper, advertising, and many other things. To find the profit, the total expenses must be subtracted from the total margin."

11. The week before Christmas our total sales amounted to $2,350. The cost of these goods was $1,726. The expenses of the week were $265. What was our profit?

THE COSTS OF RUNNING A RETAIL STORE

The grocer performs a great many services for the housewife. He assembles a variety of foods, stores them, keeps them in good condition, grades them, pays the expenses of selling and delivering them. For these services we must pay. The table below shows how these costs are distributed in every dollar that we spend. The figures are based on reports from 433 retail grocery stores.

Cost of the material sold	$.807
Selling expenses, as clerks' wages, advertising, etc.	.078
Delivery	.028
Management	.026
Rent and upkeep	.037
Losses from bad debts	.004
Other expenses	.007
Total expenses	?
Profit	.013

1. When you spend $1 at a grocery store, what amount is paid by the grocer for the materials that you buy?

2. How much is added to this cost for selling expenses? for delivery? for each of the other items?

3. What profit does the grocer make on the $1 purchase?

4. Find the total amount that you pay the retailer for running expenses and profits.

5. If a grocer sold $300 worth of groceries on Saturday, what would his profit be?

6. What items in the grocer's expenses would be removed in a cash-and-carry business?

7. On a $5 order, how much is the grocer's profit?

HOW PRICES ARE DECIDED UPON

Mary Smith's father buys vegetables, groceries, eggs, and other articles of food from farmers and sells them to people in the city. He adds a certain amount of money to what he pays for the products to cover the expenses of running his store. Usually an amount equal to about 25% or 30% of the cost is added to establish a selling price. Sometimes the selling price must be changed a little to find a price that is easier to deal with. Imagine that you were Mr. Smith, a grocer, and were deciding at what prices to sell certain articles. Add 25% to the price that you pay for each item. Then decide upon a convenient selling price.

	Mr. Smith Paid	Cost Price + 25%	Convenient Selling Price
1. Apples	$1.00 a bushel	?	?
2. Peaches	1.45 a bushel	?	?
3. Potatoes	1.60 a bushel	?	?
4. Carrots	6¢ a pound	?	?
5. Onions	2¢ a bunch	?	?
6. Cherries	11¢ a box	?	?
7. Butter	38¢ a pound	?	?
8. Sweet Corn	15¢ a dozen	?	?

9. How much higher would the selling prices of each have been if Mr. Smith had added 30% to the cost price? Make out a new price list, using 30%, and find the differences in the selling prices.

10. What per cent of the selling price is the margin on each of the products listed in problems **1-8**?

***11.** Many people buy foodstuffs directly from the farmer. Often his prices are lower than those asked in the stores. Why is this?

TRADE DISCOUNT

Mr. Stephens manages a hardware store. Here is a bill which a wholesale merchant sent to him.

THE JACKSON HARDWARE SUPPLY CO.

ST. PAUL, MINNESOTA

January 5, 19__

SOLD TO John C. Stephens
Anoka, Minn

TERMS: 10 days SHIPPED BY freight

3	Radio B Batteries @ $8.75	26.25	
10	Aerials @ $1.90	19.00	
		45.25	
	Discount 40%	18.10	
			$27.15

The Jackson Hardware Supply Company is a wholesale house which sells many different kinds of hardware in large quantities to retail dealers. The company furnishes each dealer with a catalogue containing a description of all merchandise at *list prices*. The dealers sell at a discount from these *list prices*. The discount is called *trade* or *commercial discount*. The rate of discount is set by the company and may be changed from time to time as business conditions demand. For each article that he buys, the dealer pays the *net price;* that is, the *list price* less the discount.

In addition to *trade* or *commercial discount*, a *cash discount*

is allowed for prompt payment by most manufacturers and wholesalers.

1. What are the list prices for each article of radio equipment that Mr. Smith bought?

2. What discount was Mr. Smith allowed on the order?

3. What was the total net price of the radio supplies? How was it found? Check each item on the bill.

4. Name three retail merchants in your neighborhood.

5. Name a wholesale merchant in your neighborhood. How can you tell that he is a wholesale merchant?

6. Mr. Smith ordered 12 golf clubs at $3.20 each. Find the net price of one golf club if he receives a discount of 15%. Find the total net price of the 12 golf clubs.

7. Make out a bill for the following articles like the bill on page 213. Show the discount, and the total net price: 25 hatchets at $.40 each; 30 axes at $.75 each; 20 hammers at $.35 each; discount, 25%.

8. A dealer buys bicycles listed at $45. He receives a discount of 20%. What is the net price?

9. What is the rate of discount on a sewing machine listed at $50 and sold for $40?

Find the discount and the net price on each of the following:

10. $32, 15%	**13.** $4.20, 15%	**16.** $350, 12%
11. $48, 5%	**14.** $3.50, 4%	**17.** $7.50, 6%
12. $3.75, 20%	**15.** 6.70, 30%	**18.** $9.25, 8%

19. A dealer buys bicycles listed at $36. He receives a discount of 20%. He is also allowed a discount of 2% on the net price for cash payment. How much does he pay for each bicycle?

SELLING GOODS ON A COMMISSION

Many boys and girls earn money by taking orders for certain kinds of goods. For selling they get a *commission*, or a certain per cent of the money which they receive from the sales.

1. Alice took subscriptions for a magazine. One week her orders amounted to $25. She kept 40% of this amount, as her commission. What was her commission?

Think: 40% of $25 = ? Alice's commission is .....

2. Alice sent to the company the money that was left after she had deducted her commission. How much did she send to the company?

Business men call the amount that Alice sent to the company the *net proceeds* of her sales.

3. Margaret took subscriptions for a book. One month her orders amounted to $75. At a commission of 35%, how much did she earn? What were the net proceeds?

4. Arthur took orders for brushes. If his commission was 25%, how much did he earn on a $5.60 order? What were the net proceeds?

5. Arthur sold 15 brushes at $.80 each. If his commission was 20%, how much did he earn?

6. Jonnard sold *Posts* at 5 cents each, and received a commission of 2 cents on each paper. His commission was what per cent of the selling price?

7. A college boy made part of his college expenses by selling photographs during the summer vacation. His commission was 30% of the sales. One week he sold 60 dozen pictures at $2.75 a dozen. What was his commission for the week?

USING COMMISSION IN BUSINESS

1. Harry's father, who is a real estate agent, sold an $8,000 house. He received 3% of the selling price as his commission. What was his commission?

2. A commission merchant sold 96 dozen eggs at 45 cents a dozen. He charged a commission of 5%. What were the net proceeds?

3. At an auction some cows belonging to Mr. Fraser brought $975. The auctioneer charged 6% commission. What were the net proceeds of the auction?

4. Mr. Smith, a clerk at Rothmires' Clothing Store, receives 5% commission on his total sales. One week his sales amounted to $846.20. What was his total commission?

5. A farmer shipped to an agent 100 barrels of apples. The agent sold the apples at $4.20 a barrel. He charged 2% commission. What was his commission?

Find the commission and net proceeds on each of the following sales:

	Sale	Rate of Commission		Sale	Rate of Commission
6.	$4.20	10%	**14.**	$675	$33\frac{1}{3}\%$
7.	$3.75	20%	**15.**	$480	$\frac{1}{3}\%$
8.	$8.50	6%	**16.**	$260	25%
9.	$32.50	12%	**17.**	$275	50%
10.	$9.80	15%	**18.**	$2,240	4%
11.	$250	2%	**19.**	$2,460	7%
12.	$748	3%	**20.**	$2,800	$2\frac{1}{2}\%$
13.	$940	40%	**21.**	$3,000	$4\frac{1}{2}\%$

***22.** A real estate agent sold a house for $8,000. His commission was $240. What was the rate of commission? What was the net price which the owner received?

DIAGNOSTIC TEST IN REDUCTION OF FRACTIONS

1. Reduce the following fractions to lowest terms.

$\frac{9}{12} =$ $\frac{15}{18} =$ $\frac{6}{15} =$ $\frac{6}{8} =$ $\frac{10}{14} =$

2. Supply the missing terms in each of the following fractions.

$\frac{1}{2} = \frac{}{4} = \frac{}{8} = \frac{}{16} = \frac{}{10} = \frac{}{14}$

$\frac{1}{4} = \frac{}{16}$ $\frac{1}{8} = \frac{}{16}$ $\frac{4}{5} = \frac{}{10}$ $\frac{2}{3} = \frac{}{9}$ $\frac{3}{4} = \frac{}{8}$

3. Change the following improper fractions to mixed numbers. Express all answers in lowest terms.

$\frac{9}{6} =$ $\frac{12}{8} =$ $\frac{19}{12} =$ $\frac{25}{10} =$ $\frac{11}{3} =$ $\frac{14}{5} =$

4. Change the following mixed numbers to improper fractions.

$1\frac{1}{4} =$ $2\frac{1}{2} =$ $7\frac{1}{3} =$ $5\frac{4}{5} =$ $8\frac{7}{8} =$ $9\frac{3}{11} =$

5. Change these pairs of unlike fractions to fractions with a lowest common denominator. The first example is already worked correctly.

a	*b*	*c*	*d*	*e*	*f*
$\frac{1}{4} = \frac{1}{4}$	$\frac{7}{8} =$	$\frac{1}{3} =$	$\frac{7}{8} =$	$\frac{3}{4} =$	$\frac{5}{6} =$
$\frac{1}{2} = \frac{2}{4}$	$\frac{3}{4} =$	$\frac{4}{5} =$	$\frac{1}{6} =$	$\frac{2}{3} =$	$\frac{3}{4} =$

6. Change $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ to twelfths.

7. Change $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{7}{8}$ to fractions having a lowest common denominator.

8. Supply the missing numerators in the following:

$7\frac{1}{2} = 6\frac{}{2}$ $5\frac{2}{3} = 4\frac{}{3}$ $6 = 5\frac{}{4}$ $8 = 7\frac{}{5}$

$3\frac{1}{2} = 2\frac{}{4}$ $5\frac{2}{3} = 4\frac{}{6}$ $9\frac{7}{8} = 8\frac{}{24}$ $15\frac{1}{6} = 14\frac{}{18}$

9. Reduce the following to simplest form:

$3\frac{9}{6} =$ $8\frac{4}{4} =$ $12\frac{12}{11} =$ $8\frac{8}{2} =$

10. Express the following as fractional parts of 100:

$12\frac{1}{2}$, 25, 75, 50, $33\frac{1}{3}$, $87\frac{1}{2}$

$66\frac{2}{3}$, $37\frac{1}{2}$, 40, $83\frac{1}{3}$, 60, $62\frac{1}{2}$

DIAGNOSTIC TEST IN ADDITION OF FRACTIONS

Row	1	2	3	4	5
I	$\frac{1}{3}$ $\frac{1}{3}$	$\frac{1}{8}$ $\frac{5}{8}$	$\frac{1}{2}$ $\frac{1}{2}$	$\frac{4}{5}+\frac{2}{5}=$	$\frac{3}{4}$ $\frac{3}{4}$
II	5 $\frac{1}{4}$	$\frac{2}{3}+7=$	4 $1\frac{2}{3}$	$3\frac{1}{2}$ 8	$2\frac{1}{4}+\frac{1}{4}+4=$
III	$3\frac{1}{5}$ $\frac{1}{5}$	$\frac{1}{4}$ $2\frac{1}{4}$	$2\frac{1}{3}+7\frac{2}{3}=$	$3\frac{3}{5}$ $2\frac{4}{5}$	$5\frac{5}{6}+2\frac{5}{6}=$
IV	$\frac{1}{2}$ $\frac{1}{4}$	$\frac{1}{2}+\frac{1}{7}=$	$\frac{1}{4}$ $\frac{1}{2}$ $\frac{1}{4}$	$\frac{1}{3}$ $\frac{5}{6}$	$\frac{7}{12}$ $\frac{3}{4}$
V	$3\frac{2}{3}$ $2\frac{1}{6}$	$1\frac{1}{4}$ $3\frac{7}{12}$	$1\frac{1}{4}$ $\frac{1}{4}$ $2\frac{1}{2}$	$7\frac{3}{4}$ $3\frac{1}{2}$	$2\frac{2}{3}$ $7\frac{5}{6}$
VI	$\frac{1}{4}$ $\frac{1}{3}$	$\frac{1}{3}$ $\frac{1}{5}$ $\frac{3}{10}$	$\frac{3}{4}$ $\frac{1}{6}$ $\frac{1}{8}$	$\frac{3}{5}$ $\frac{1}{2}$ $\frac{1}{4}$	$\frac{2}{3}$ $\frac{4}{5}$ $\frac{7}{10}$
VII	$4\frac{1}{5}$ $1\frac{1}{4}$	$1\frac{1}{6}$ $7\frac{3}{5}$ $3\frac{1}{6}$	$\frac{5}{6}+\frac{3}{4}+\frac{5}{12}=$	$6\frac{2}{3}$ $4\frac{3}{4}$	$5\frac{3}{5}$ $7\frac{1}{4}$ $\frac{1}{4}$
VIII	$5\frac{1}{12}$ $\frac{5}{6}$	$\frac{5}{12}$ $1\frac{1}{3}$	$\frac{2}{3}$ $\frac{1}{4}$ $4\frac{1}{12}$	$\frac{2}{5}$ $1\frac{2}{3}$	$3\frac{17}{24}$ $4\frac{5}{6}$ $3\frac{5}{8}$

DIAGNOSTIC TEST IN SUBTRACTION OF FRACTIONS

Row	1	2	3	4	5
I	$\frac{2}{3}$ $\frac{1}{3}$	$\frac{5}{8}$ $\frac{1}{8}$	$4\frac{4}{5}-\frac{1}{5}=$	$4\frac{2}{3}$ $\frac{2}{3}$	$7\frac{5}{6}$ $\frac{1}{6}$
II	$5\frac{1}{4}$ 3	$2\frac{1}{8}-2=$	$4\frac{3}{5}$ $2\frac{1}{5}$	$3\frac{3}{4}$ $2\frac{3}{4}$	$7\frac{5}{8}-2\frac{3}{8}=$
III	$9-\frac{1}{2}=$	1 $\frac{1}{4}$	3 $1\frac{2}{3}$	$6-5\frac{2}{3}=$	$2\frac{1}{8}$ $\frac{1}{8}$
IV	$6\frac{1}{3}$ $\frac{2}{3}$	$7\frac{1}{8}$ $\frac{5}{8}$	$10\frac{1}{3}$ $3\frac{2}{3}$	$9\frac{3}{5}$ $8\frac{4}{5}$	$4\frac{1}{6}-1\frac{5}{6}=$
V	$\frac{1}{2}$ $\frac{1}{4}$	$\frac{1}{2}-\frac{1}{6}=$	$3\frac{3}{4}$ $\frac{1}{2}$	$6\frac{1}{4}$ $6\frac{1}{8}$	$4\frac{1}{3}$ $\frac{1}{12}$
VI	$7\frac{1}{2}$ $4\frac{2}{4}$	$3\frac{5}{6}-1\frac{2}{3}=$	$7\frac{3}{5}$ $1\frac{1}{10}$	$2\frac{2}{3}-\frac{5}{6}=$	$3\frac{1}{4}$ $\frac{11}{12}$
VII	$\frac{1}{3}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{1}{6}$	$2\frac{3}{8}-\frac{1}{3}=$	$4\frac{5}{6}$ $\frac{3}{8}$	$1\frac{1}{8}-\frac{1}{3}=$
VIII	$4\frac{5}{6}-1\frac{2}{5}=$	$3\frac{5}{8}$ $1\frac{1}{6}$	$3\frac{5}{6}-1\frac{3}{4}=$	$8\frac{1}{8}$ $1\frac{1}{2}$	$7\frac{1}{8}-\frac{1}{4}=$
IX	$3\frac{7}{8}-1\frac{1}{12}=$	$4\frac{1}{4}-\frac{5}{6}=$	$3\frac{1}{4}$ $1\frac{2}{3}$	$5\frac{1}{5}-\frac{2}{3}=$	$7\frac{1}{5}$ $6\frac{3}{4}$

DIAGNOSTIC TEST IN MULTIPLICATION OF FRACTIONS

Multiply. When possible, change improper fractions to mixed numbers and common fractions to lowest terms.

Row	1	2	3	4	5
I	$\frac{1}{4}\times 8=$	$\frac{1}{9}$ of $3=$	$\frac{2}{5}\times 2=$	$\frac{2}{3}\times 16=$	$\frac{5}{6}\times 1\frac{4}{7}=$
II	$2\times\frac{4}{9}=$	$3\times\frac{1}{3}=$	$4\times\frac{1}{2}=$	$12\times\frac{1}{5}=$	$8\times\frac{1}{6}=$
III	$\frac{1}{4}$ of $\frac{1}{6}=$	$\frac{1}{4}\times\frac{8}{9}=$	$\frac{1}{2}\times\frac{7}{10}=$	$\frac{5}{9}\times\frac{3}{7}=$	$\frac{5}{8}\times\frac{16}{25}\times\frac{1}{2}=$
IV	$6\times 2\frac{1}{3}=$	$7\times 4\frac{1}{2}=$	$6\times 3\frac{3}{4}=$	$2\times 4\frac{1}{5}=$	$6\times 3\frac{3}{8}\times 2\frac{4}{5}=$
V	$2\frac{1}{4}\times\frac{1}{4}=$	$3\frac{1}{5}\times 2=$	$3\frac{1}{6}\times 4=$	$3\frac{2}{3}\times 8=$	$5\frac{3}{8}\times 6\times 2\frac{1}{3}=$
VI	$\frac{1}{4}\times 2\frac{1}{2}=$	$\frac{1}{2}$ of $1\frac{1}{5}=$	$\frac{5}{8}\times 6\frac{2}{5}=$	$\frac{2}{5}\times 3\frac{2}{3}=$	$\frac{2}{3}\times 4\frac{3}{4}\times\frac{2}{3}=$
VII	$3\frac{1}{3}\times\frac{2}{9}=$	$3\frac{1}{3}\times\frac{1}{8}=$	$7\frac{1}{2}\times\frac{2}{5}=$	$6\frac{4}{5}\times\frac{3}{7}=$	$3\frac{1}{5}\times\frac{3}{8}\times\frac{8}{9}=$
VIII	$2\frac{1}{2}\times 2\frac{1}{4}=$	$6\frac{1}{4}\times 6\frac{2}{5}=$	$3\frac{3}{4}\times 3\frac{1}{3}=$	$3\frac{2}{7}\times 2\frac{2}{3}=$	$4\frac{3}{8}\times 2\frac{6}{7}\times 1\frac{4}{5}=$
IX	24 $3\frac{1}{8}$	$36\frac{5}{6}$ 12	18 $15\frac{3}{4}$	$25\frac{1}{2}$ 27	23 $18\frac{3}{5}$

DIAGNOSTIC TEST IN DIVISION OF FRACTIONS

Divide. Reduce all fractions in the answers to lowest terms.

Row	1	2	3	4	5
I	$5 \div \frac{1}{2} =$	$5 \div \frac{2}{3} =$	$12 \div \frac{3}{4} =$	$14 \div \frac{4}{5} =$	$2 \div \frac{4}{5} =$
II	$\frac{1}{7} \div \frac{1}{6} =$	$\frac{1}{9} \div \frac{1}{3} =$	$\frac{3}{8} \div \frac{3}{8} =$	$\frac{13}{15} \div \frac{1}{2} =$	$\frac{5}{6} \div \frac{3}{10} =$
III	$1\frac{1}{4} \div \frac{1}{3} =$	$1\frac{1}{2} \div \frac{1}{2} =$	$1\frac{3}{8} \div \frac{3}{10} =$	$2\frac{5}{8} \div \frac{3}{4} =$	$9 \div 8 =$
IV	$\frac{1}{5} \div 5 =$	$\frac{5}{6} \div 4 =$	$\frac{5}{9} \div 5 =$	$\frac{4}{5} \div 6 =$	$10 \div 6 =$
V	$1\frac{1}{3} \div 5 =$	$1\frac{1}{5} \div 4 =$	$5\frac{2}{3} \div 5 =$	$5\frac{3}{5} \div 2 =$	$4\frac{3}{5} \div 6 =$
VI	$\frac{1}{3} \div 1\frac{1}{2} =$	$\frac{3}{8} \div 1\frac{2}{3} =$	$\frac{5}{12} \div 1\frac{5}{6} =$	$\frac{1}{6} \div 1\frac{1}{2} =$	$8 \div 14 =$
VII	$2 \div 2\frac{1}{2} =$	$3 \div 4\frac{1}{2} =$	$5 \div 2\frac{3}{4} =$	$5 \div 2\frac{1}{2} =$	$12 \div 6\frac{3}{5} =$
VIII	$1\frac{1}{5} \div 3\frac{1}{2} =$	$1\frac{1}{3} \div 3\frac{1}{3} =$	$2\frac{3}{8} \div 2\frac{3}{8} =$	$3\frac{1}{3} \div 1\frac{3}{4} =$	$3\frac{3}{8} \div 1\frac{1}{4} =$

DIAGNOSTIC TEST IN ADDITION OF DECIMALS

Find the following sums correctly:

1.	.4 .1 .3	**3.**	.3 .5 .8	**5.**	.16 .25 .37	**7.**	.28 .43 .95	**9.**	.02 .03 .04
2.	.05 .09 .08	**4.**	1.06 2.08 3.04	**6.**	1.75 2.125 3.8	**8.**	2.75 4. 16.375	**10.**	3.26 .04 1.1

11. Find the sum of 9.65, 8.375, and 6.4.

12. Find the sum of .8, 3, and .125.

DIAGNOSTIC TEST IN SUBTRACTION OF DECIMALS

Can you do these subtraction examples correctly?

1.	.8 .3	**5.**	.5 .5	**9.**	.16 .04	**13.**	.38 .15	**17.**	.43 .41
2.	.375 .269	**6.**	.7 .35	**10.**	.9 .275	**14.**	.4 .375	**18.**	.6 .004
3.	9.6 3.4	**7.**	18.5 4.6	**11.**	27.08 15.17	**15.**	9.3 6.25	**19.**	18.2 1.625
4.	18.75 1.4	**8.**	.65 .5	**12.**	.375 .21	**16.**	9.637 5.	**20.**	3.748 3.7

21. Subtract 3.825 from 20.

22. Subtract .5 from .75.

DIAGNOSTIC TEST IN MULTIPLICATION OF DECIMALS

1. $4 \times .2 =$	**2.** $4 \times .02 =$	**3.** $4 \times .002 =$
4. $5 \times .3 =$	**5.** $6 \times .04 =$	**6.** $7 \times .008 =$
7. $8 \times .5 =$	**8.** $6 \times .05 =$	**9.** $4 \times .005 =$

10. 2.6 × 4	**11.** 3.5 × 8	**12.** 3.28 × 4	**13.** 4.647 × 5
14. 85 × .4	**15.** 20 × .6	**16.** 32 × 1.4	**17.** 2.5 × 48
18. $.4 \times .2 =$	**19.** $.5 \times .03 =$	**20.** $.8 \times .25 =$	
21. 7.8 × 6.4	**22.** 6.5 × 4.8	**23.** 18.4 × .26	**24.** 8.04 × .03
25. $10 \times 8.5 =$	**26.** $10 \times .96 =$	**27.** $100 \times .14 =$	
28. $100 \times 8.5 =$	**29.** $100 \times 8.65 =$	**30.** $200 \times 9.4 =$	

DIAGNOSTIC TEST IN DIVISION OF DECIMALS

When necessary, carry the work to three places only.

1.	$4\overline{)8.4}$	**11.**	$3\overline{)7.47}$	**21.**	$8\overline{)16.896}$
2.	$2\overline{).8}$	**12.**	$4\overline{).76}$	**22.**	$6\overline{).972}$
3.	$4\overline{).12}$	**13.**	$6\overline{).042}$	**23.**	$24\overline{)1.2}$
4.	$8\overline{)4}$	**14.**	$8\overline{)6}$	**24.**	$25\overline{)2}$
5.	$25\overline{)64}$	**15.**	$33\overline{)87}$	**25.**	$25\overline{)8.725}$
6.	$.3\overline{)3.6}$	**16.**	$.3\overline{)18.63}$	**26.**	$.4\overline{)1.2}$
7.	$.3\overline{)6}$	**17.**	$.2\overline{)10}$	**27.**	$.4\overline{)3}$
8.	$.7\overline{)4}$	**18.**	$.11\overline{)1.21}$	**28.**	$.11\overline{)1.342}$
9.	$.11\overline{)3.3}$	**19.**	$.12\overline{)6}$	**29.**	$.12\overline{)9}$
10.	$1.25\overline{)6.75}$	**20.**	$6.48\overline{)7.128}$	**30.**	$.834\overline{)91.74}$

USING ARITHMETIC LANGUAGE

You have learned many things about arithmetic. Study the following questions and be ready to answer them orally. This will be a good test of how well you understand what you have learned.

1. What must you know to find the area of a field?

2. What must you know to find the volume of a box?

3. Why is it necessary to change unlike fractions to a common denominator before adding, or subtracting them?

4. How does cancellation help in finding the answer to an example in which small mixed numbers are multiplied?

5. What does it mean to invert a fraction?

6. How can the fraction $\frac{5}{8}$ be changed to a decimal? to a per cent?

7. How can a decimal be changed to a common fraction?

8. In multiplying two decimals, how many decimal places must be pointed off in the product?

9. Explain the method you use in dividing a decimal by a decimal. You may use an example if you wish.

10. How can you find a per cent of a number?

11. How can you find what per cent one number is of another?

12. What is meant by interest? How is it computed?

13. What is meant by profit and loss?

14. What is the difference between margin and profit?

15. What is discount?

16. What is an account? a sales slip? a bill? a check?

17. What are denominate numbers? compound denominate numbers?

18. Express 3.6¢ as a decimal of a dollar.

19. What does it mean to draw to scale?

20. What is meant by the ratio of two numbers? Name ways of comparing two numbers.

COMMON FRACTIONS, DECIMALS, AND PER CENTS

1. Express the following per cents as common fractions and as decimals: 1%; 8%; 5%; $3\frac{1}{2}$%; 10%; 100%; 20%; $5\frac{1}{4}$%; $22\frac{1}{2}$%; $\frac{1}{2}$ of 1%; $4\frac{1}{2}$%; $12\frac{1}{2}$%; $8\frac{1}{3}$%.

2. Express the following common fractions as decimals and as per cents: $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{5}$; $\frac{4}{5}$; $\frac{3}{4}$; $\frac{3}{100}$; $\frac{3}{50}$; $\frac{1}{800}$; $\frac{1}{8}$; $\frac{3}{25}$; $\frac{3}{8}$.

3. Express the following decimals as common fractions or mixed numbers, and as per cents: .03; .12; .125; .45; .05; .005; .045; .032; .55; .002; .825; 1.35; 2.05; 4.025.

4. Find 5% of 100; $.05 \times 100$; $\frac{1}{20}$ of 100.

5. Find $1\frac{1}{4} \times 100$; 125% of 100; 1.25×100.

6. Find $.36 \times 200$; 36% of 200; $\frac{9}{25}$ of 200.

7. Write two fifths as a common fraction, as a decimal, and as a per cent.

8. Which is the greater reduction, $33\frac{1}{3}$% or $\frac{2}{7}$?

APPLICATIONS OF PER CENT

1. One day 30 per cent of a class of 36 children were absent. How many were present?

2. Here are the scores that three pupils made on a test of 20 examples. What per cent did each one have correct?

Harry, 19 examples correct
Alice, 20 examples correct
Jack, 15 examples correct

3. On a test of 25 words, Mary had 92 per cent spelled correctly. How many words did she misspell?

4. One Saturday Harry collected some money for his father. He collected in all $75. His father gave him 2% of all of the money he collected. How much did Harry receive from his father?

5. Mary's father was a real estate agent. He sold a house for Mr. Jackson for $10,000. Mr. Jackson paid him 5% of this amount for selling the house. What did Mr. Jackson pay Mary's father?

6. During one month, Patty Lee, Julia's cow, yielded 750 pounds of milk. At the end of the month the creamery paid Julia for 30 pounds of butterfat from this milk. What per cent of the milk was butterfat?

7. Henry bought a puppy for $2.50 and sold it for $4.00. What was his gain? What per cent was this of the cost of the puppy?

8. Which would be cheaper, a $20 chair bought at a "$\frac{1}{3}$-off" sale or a $20 chair bought at a "30%-off" sale?

9. During one season the Lincoln baseball team played 48 games. The team won all but 6 of them. What per cent of the games did they win?

10. Mr. Smith bought an automobile for $850. After he had used the car for a year, he sold it for 20% less than it cost him. How much did he receive for it?

DIAGNOSTIC TEST IN PER CENT

1. Express the following as per cents:

.25 .06 1.15 .2 1.4 .12$\frac{1}{2}$ .375

2. Express the following as hundredths:

28% 7% 3.5% 120% 146% 33$\frac{1}{3}$%

3. Express the following as per cents:

$\frac{1}{2}$ $\frac{1}{4}$ $\frac{2}{5}$ $\frac{1}{3}$ $\frac{7}{10}$ $\frac{9}{25}$ $1\frac{1}{8}$

4. Find:

6% of \$200	120% of \$48	3.6% of 200 lb.
20% of \$375	$33\frac{1}{3}$% of \$150	146% of 300 bu.

5. Find the missing numbers:

15 = —% of 20	35 = —% of 105	80 = —% of 1,000
75 = —% of 150	60 = —% of 50	35 = —% of 2,000

6. Express three-fourths as a fraction, a decimal, and a per cent.

7. Find the interest on \$6.00 for 3 years at 6 per cent.

8. What part of a number is 100 per cent of that number?

9. Subtract 3.6% from 90%.

10. Add 7.8%, 6.4%, 7.3%, and 5.4%.

Practice on other examples similar to those with which you have special difficulty.

PROBLEM TESTS

Test I

1. Harry's father bought 10 gallons of gasoline at 24¢ a gallon, and 5 gallons of oil at 75¢ a gallon. How much did he pay for gasoline and oil?

2. An airplane traveled 172.5 miles in 1.5 hours. Find the speed an hour.

3. In the sixth grades of a large school, 52 per cent of the children were boys. Find the number of girls, if there were 100 sixth-grade children in all.

4. Find the interest on \$250 for 3 years at 6 per cent.

5. Find the volume of a rectangular tank, 6 feet long, 4 feet wide, and 2 feet deep.

Test II

1. Of a class of 40 children, 25 had perfect papers on an arithmetic test. What per cent did not have perfect papers?

2. A $50-chair was on sale at a discount of 25 per cent. Find the sale price.

3. Find the length of a 10-acre piece of ground that is 120 rods wide.

4. On a map a line $\frac{1}{4}$ inch long represents 5 miles. What is the distance on this map between two places which are really 75 miles apart?

5. At a sale Mrs. Johnson bought $3\frac{3}{4}$ yards of cloth for $2.25. If the regular price of the cloth was $.90 a yard, how much less than the regular price was the sales price a yard?

Test III

1. Find the cost of excavating a basement 25 feet by 30 feet by 6 feet at $1.25 a cubic yard.

2. Find the cost of linoleum for a floor 12 feet 8 inches by 7 feet 6 inches at $2.10 a square yard.

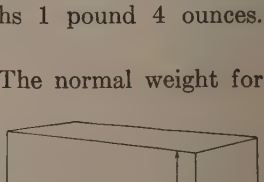
3. Find the cost of one ton of coal if $5\frac{3}{4}$ tons cost $71.76.

4. A large can of peaches weighs 1 pound 4 ounces. Find the weight of 12 cans.

5. Harry weighed $95\frac{7}{8}$ pounds. The normal weight for a boy his age is 100 pounds. Find the per cent he was underweight.

6. Find the interest on $125 for 6 months at 6%.

7. Find the volume of the figure at the right.



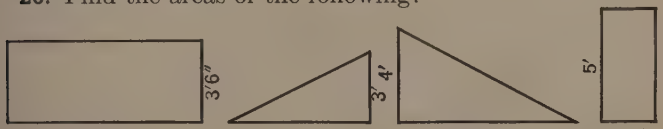
DIAGNOSTIC TEST VI

This exercise will test your ability to work different kinds of examples. If you have difficulty with any of the examples, practice on others like them.

1. $3\frac{3}{4} + 5\frac{5}{6} + 18\frac{7}{8} =$
2. Subtract $17\frac{1}{8}$ from $26\frac{1}{8}$.
3. Multiply: $3\frac{1}{3} \times 5 \times 8\frac{1}{4} =$
4. Divide $12\frac{1}{2}$ by $3\frac{1}{3}$.
5. Change $\frac{1}{8}$ to a decimal and to a per cent.
6. Change .15 to a common fraction.
7. Find the sum of 12.9, 9.98, 7.641, and 48.
8. Subtract 9.856 from 9.91.
9. Multiply 1.74 by .06.
10. Divide 71.28 by .648.
11. Express the following as per cents:

    .05 .2 1.2 $.12\frac{1}{2}$ 3.0 1.37 .16
12. Express the following as decimals:

    6% 15% 210% 50% 100% $16\frac{2}{3}\%$ $87\frac{1}{2}\%$
13. Find 8% of \$125; 75 lb.; \$96.00.
14. 18 = —% of 50.
15. 3 = —% of 40.
16. 75 = —% of 60.
17. \$1.60 = —% of \$20.00.
18. Find the interest on \$300 for 6 months at 5%.
19. Subtract 6 bu. 12 qt. from 8 bu. 5 qt.
20. Find the areas of the following:



PROBLEM SCALE VI

Standards	
Excellent	9 or 10 correct
Good	7 or 8 correct
Fair	5 or 6 correct
Unsatisfactory	0 to 4 correct

1. Jack earned \$1.20 for 6 hours of work in the neighbor's garden. What did he earn an hour?

2. Helen weighed $87\frac{1}{2}$ pounds. Her normal weight was 92 pounds. How much underweight was Helen?

3. Harry's father traveled 45 miles in 1.5 hours. How many miles did he travel an hour on the average?

4. Ten pounds of sugar cost 62 cents. What is the price a pound?

5. On a test of 20 words Mary spelled 75 per cent correctly. How many did she spell correctly?

6. On a test of 25 words Harry spelled 20 words correctly. What per cent did he spell correctly?

7. Mr. Smith's income last year was \$4,250. He saved 21% of this. How much did he save?

8. Mr. Smith's prize Jersey cow yields about 4.5 pounds of butterfat a 100 pounds of milk. How much butterfat would 1,200 pounds of her milk yield?

9. On an arithmetic test containing 20 problems Helen had 90% correct. How many did she have incorrect?

10. Jack gave half of the $4\frac{1}{2}$ pounds of walnuts he had picked to Harry. Harry already had $1\frac{1}{2}$ pounds of pecans. How many pounds of nuts did Harry then have?

D

TABLES OF MEASURES

For Reference

Counting

12 things = 1 dozen
12 dozen = 1 gross
20 things = 1 score

Capacity

Liquid Measure

4 gills = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon
231 cubic inches = 1 gallon

Dry Measure

2 pints = 1 quart
8 quarts = 1 peck
4 pecks = 1 bushel
2,150.42 cubic inches = 1 bushel

Weight

Avoirdupois Weight

16 ounces = 1 pound
100 pounds = 1 hundredweight (cwt.)
2,000 pounds or 20 hundredweight = 1 ton
2,240 pounds = 1 long ton

196 pounds = 1 barrel of flour
62.5 pounds = 1 cubic foot of water
*60 pounds = 1 bushel of wheat or potatoes
*56 pounds = 1 bushel of corn or rye

Troy Weight

For jewels and precious metals

24 grains = 1 pennyweight (pwt.)
20 pennyweights = 1 ounce
12 ounces = 1 pound
5,760 grains = 1 pound (Troy)
7,000 grains = 1 pound (Avoirdupois)

Length

12 inches = 1 foot
3 feet = 1 yard
$16\frac{1}{2}$ feet or $5\frac{1}{2}$ yards = 1 rod
5,280 feet / 1,760 yards / 320 rods = 1 mile
4 inches = 1 hand
6 feet = 1 fathom
1.151 common miles = 1 knot
3 knots = 1 league
360 degrees = 1 circumference

Surface or Square Measure

144 square inches = 1 square foot
9 square feet = 1 square yard
$30\frac{1}{4}$ square yards = 1 square rod
160 square rods or 43,560 square feet = 1 acre
640 acres = 1 square mile, or 1 section
36 sections = 1 township

*In most states.

Solid or Cubic Measure

1,728 cubic inches = 1 cubic foot
27 cubic feet = 1 cubic yard

Wood measure

16 cubic feet = 1 cord foot
128 cubic feet, or
8 cord feet = 1 cord
$24\frac{3}{4}$ cubic feet = 1 perch of stone

Time Measure

60 seconds = 1 minute
60 minutes = 1 hour
24 hours = 1 day
7 days = 1 week
365 days = 1 year
366 days = 1 leap year

Metric System (Equivalents)

10 millimeters = 1 centimeter
100 centimeters = 1 meter
100 meters = 1 kilometer

1 inch = 2.54 centimeters
1 foot = 30.48 centimeters
1 yard = 0.9144 meters
1 mile = 1.6093 kilometers

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(All problem units are indexed under problems)

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